JUNE, 1946

THE WELDING ENGINEER

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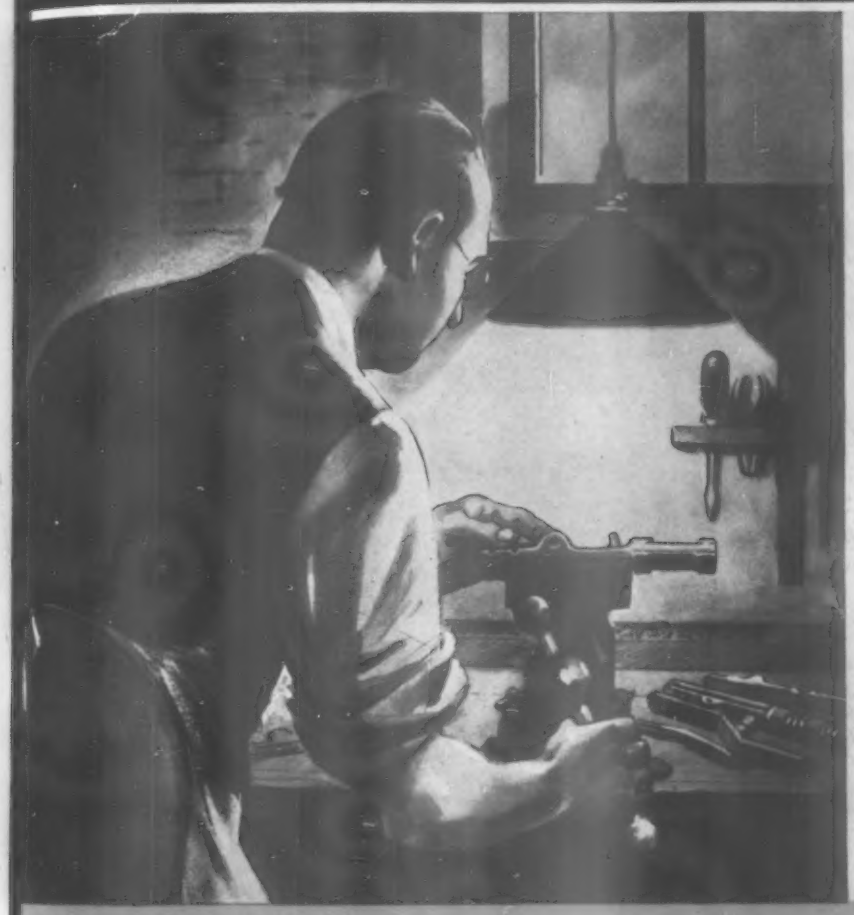
JUN 28 1946



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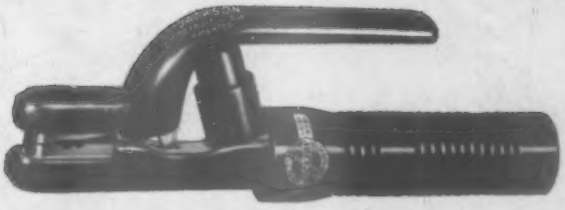

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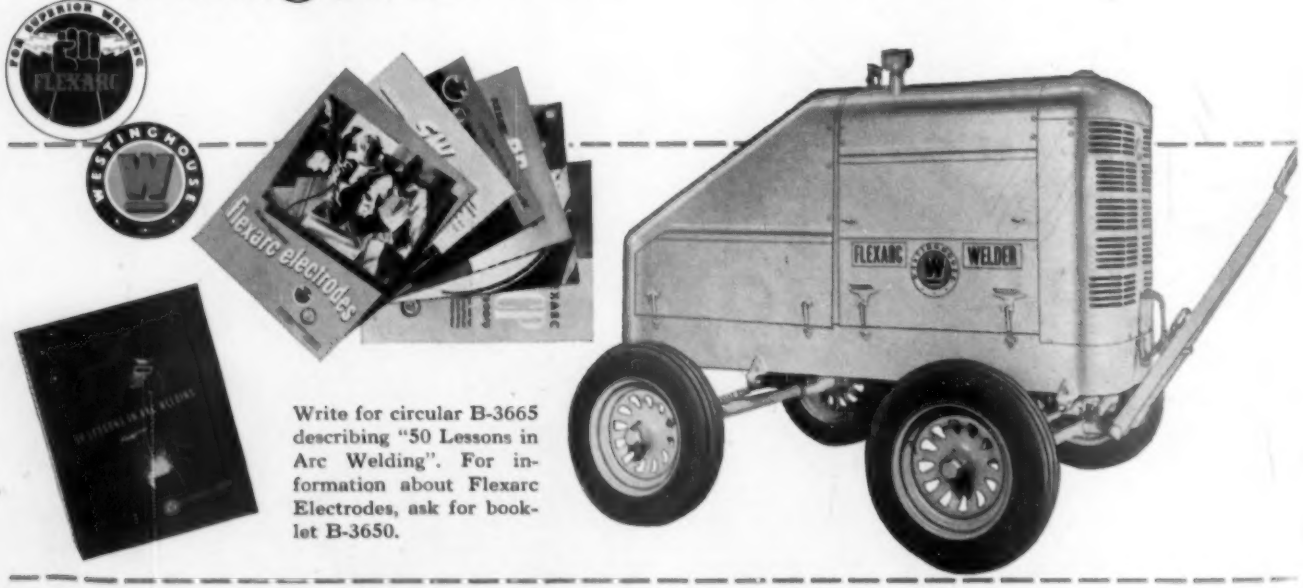

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★ PRODUCTION

Ryan Welding Innovations

BY WILLIAM P. BROTHERTON *Technical Editor, Ryan Aeronautical Co.*

One of the world's outstanding producers of exhaust systems, Ryan Aeronautical Co. has devised many ingenious gas, arc and resistance-welding techniques to join the intricately formed stainless-steel parts of exhaust manifolds.

UNDER the intense impetus of war, the Ryan Aeronautical Co., San Diego, Calif., forged ahead in the race to develop new welding techniques to join stainless steel. Ryan perfected rapid welding methods to "stitch" together over 100,000 huge stainless-steel exhaust manifolds for the engines of America's warplanes.

TORCH WITH TWO TIPS

Ryan metallurgists and welding engineers have devised new fusion techniques as well as adapted the welding procedures of other industries to the special needs of aviation. Some of these unusual innovations may have valuable significance for other manufacturers meeting similar problems.

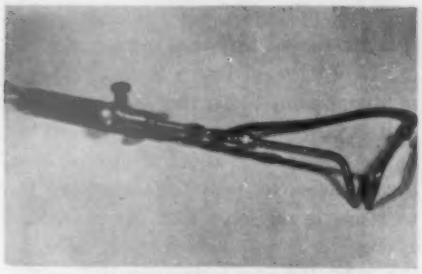


Fig. 1—This unique torch, designed by Frederick S. Dever, Ryan welding supervisor, has two tips

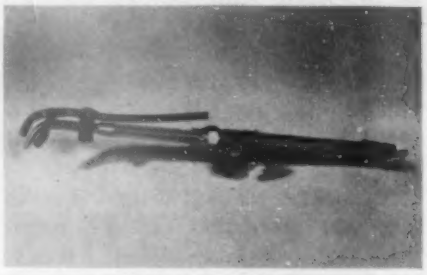


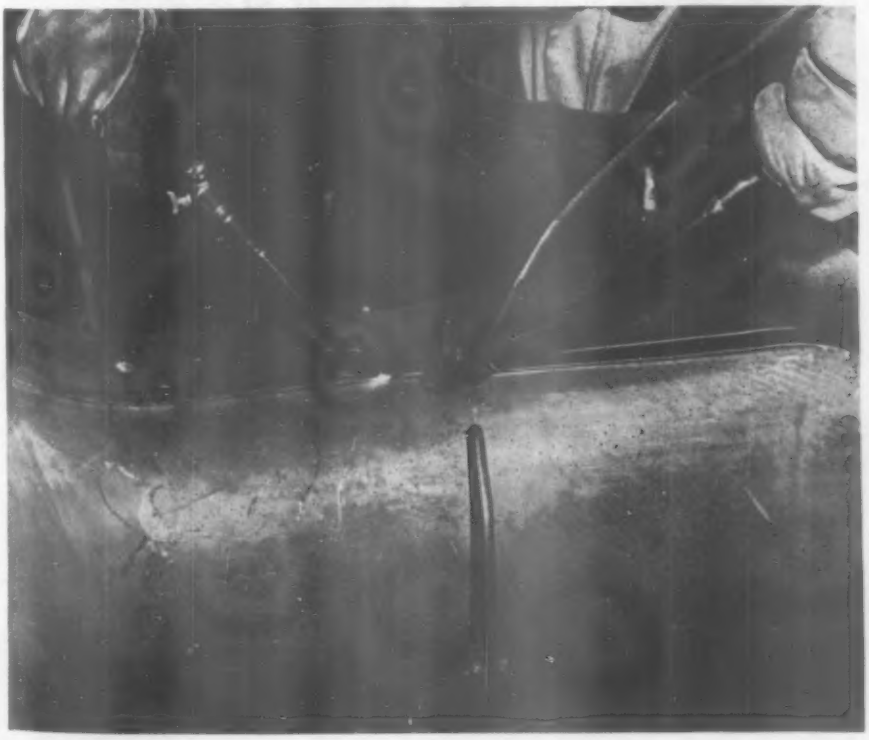
Fig. 2—Another Dever invention, a three-tip welding torch that preheats, welds and postheats

Frederick S. Dever, welding supervisor at Ryan, devised a new type of oxy-acetylene gas welding torch which has two tips (Fig. 1). This torch steps up the production of exhaust systems by performing two operations simultaneously; *i.e.*, trimming the extra flange metal and welding the seam. Previously, it had been necessary to trim the flange with a "jitterbug" cutter and then tack the sections together prior to seam welding.

The tips of the torch direct the heat against opposite sides of the flange. The outside tip has a smaller diameter because it is the preheating tip. It preheats the metal and permits the welding speed to be raised from 2½ to 7½ in. per minute. One adjustment takes care of both tip flames. The increased temperature derived from the two tips strips the flange from the assembly and also welds the remaining seam.

Dever also designed and built a welding torch having three tips: a special pair of natural gas tips in addition to the regular oxy-acetylene tip

Fig. 3—The pliers align and hold the edges of a flange for flame tacking. The clamp is adjustable to any diameter of these steel sections



(Fig. 2). The natural gas is burned ahead and behind the welding tip in order to preheat and postheat the stainless steel concurrently with welding. The postheating is done so that the material will not cool too rapidly behind the weld and cause cracking.

Stainless steel has a high coefficient of expansion, twice that of mild steel, and is, therefore, particularly subject to distortion. The effect of abrupt heating followed by rapid cooling after the weld is a scissors-like stress which cracks the metal. The greater the welding rate, the more pronounced is this effect. Yet rapid welding of stainless steel is very desirable because it reduces the loss of corrosion resistance of the steel. With Dever's three-tip torch, welding speed can be increased to six inches a minute with excellent results. An additional advantage is the prevention of oxidation since the flow of postheating gas protects the welded area from the air.

A novel technique is utilized in order to prevent oxidation of the internal weld seam in long closed sections. Natural gas is introduced into one end of the structure, and the other end is sealed with wet asbestos. As the gas burns within the tube, it consumes the available oxygen and thereby effectively prevents the oxidation of the weld area.

Two valuable tools designed to simplify the welding job are the tacking pliers and adjustable clamp (Fig. 3). These pliers are used to align and hold the edges of a flange for spot tacking with a torch. Gas tacking is used instead of spot-weld tacking on structures of this type because of their large and complex shapes.

Fig. 4—These half-stampings are being spot tacked to hold the alignment for subsequent oxy-acetylene seam welding (see Fig. 5 on opposite page)

The faces of the pliers are ground and hard-faced with a cobalt-chromium-tungsten alloy. In addition to the claws, there is a metal finger which extends down between the flange edges and lines them evenly for tacking. The clamp, snugly holding the steel sections, is an adjustable model which fits any diameter. It extends down to a special ball-and-socket swivel for positioning in any plane.

The Ryan Aeronautical Co. was one of the first aircraft companies to install atomic-hydrogen welding equipment and one of the first to use it with the light-gauge stainless steels of aviation.* Ryan designed lightweight electrode holders weighing half as much as the standard holders supplied with the equipment and also a conveyor machine which makes automatic atomic-hydrogen welding possible at speeds as great as 28 in. a minute. This rate forms a striking comparison with the oxy-acetylene rate of 5 in. per minute or the 10 to 12 in. for metal-arc welding.

Fig. 6—The lower electrode is of heat-treated steel, with a copper insert added for good conductivity

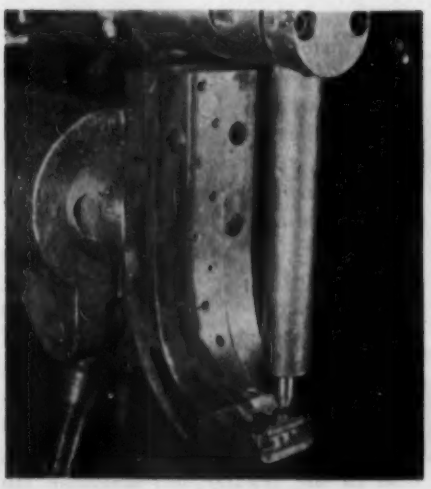


Fig. 7—This tong-type welding gun is used to spot tack engine cowls

Spot-Tacking Procedure

One of the greatest aids in taking the manufacture of exhaust manifolds from hand methods to mass production was the development of rapid "spot tacking" for the assembly of stainless-steel half-stampings. Before this innovation, the half-stampings were taken from the drop hammers, thoroughly cleaned and assembled with clamps for oxy-acetylene seam welding. The parts had to be very carefully held together in the clamps so that the edges would fit correctly for the seam welding.

With the new technique (Fig. 4), the half-stampings are quickly spot-tacked together without the need for adjusting holding clamps. The operator merely holds the parts in alignment while as many as 120 spots per minute are

* "Welding Thin-Gauge Stainless Steel," The Welding Engineer, April 1946.

Fig. 5—The twin-tip torch (Fig. 1) becomes a cutting torch as it welds. The material melted from the base of the flange forms the weld bead, and the resulting gap automatically severs the surplus flange stock from the part

located to stitch the two halves together prior to oxy-acetylene seam welding. These units are welded with the twin-tip torch without added filler material (Fig. 5).

Odd-Shaped Electrode

Many unusually shaped electrodes are used to spot weld odd or hard-to-reach assemblies. Erich Faulwetter, sheet-metal supervisor at Ryan, designed a large lower electrode of heat-treated steel with a copper insert (Fig. 6). The high strength of the steel prevents deflection. This peculiar looking electrode was developed to permit the spot welding of an otherwise extremely inaccessible structure. The upper electrode, more conventional in appearance, is water cooled.

A tong-type spot-welding gun having a mechanically operated pressure device has been very useful in the spot tacking of an engine cowl (Fig. 7). Pressure is exerted by a lever arrangement. This tool has a solenoid switch control to time the discharge of current and extra long electrodes that will reach remote areas.

Perhaps the most novel spot welder in the Ryan plant is the portable gun shown in Fig. 8. Although this welder weighs 60 lb, it is easily handled because it is suspended by a counterbalanced cable which holds it in any position. The electrodes are operated by air pressure and water cooled. Because its electrodes can be inserted into narrow openings having less than 3½ in. of vertical clearance, this gun is employed for many difficult jobs such as the spot welding of engine cowlings and fire walls.

Some Parts Are Flash Welded

Probably the highest quality weld which can be made is accomplished by flash-welding machines which bring two edges together in butt-to-butt fashion and establish an arc between them (Fig. 9). When the metal becomes molten, the arc is extinguished and the two edges are pressed together (forged) in a shower of sparks. This weld will be free of impurities resulting from exposure to the atmosphere at high temperatures because a blanket of molten metal (later expelled) protects the plastic weld zone.

No story about Ryan's welding methods would be complete without mention of the fast, accurate metal-arc process. To weld stainless steel, the amount and location of the heat application must be closely controlled. By varying the current, exactly the right amount of heat for good fusion can be applied. Careful selection of filler rods must be made, however, to insure that the added metal will not disturb the balance of the stabilizing agent or the carbon in the weld metal.

The contributions which the metallurgists and other laboratory scientists have made to the advancement of welding practices are enormous. Working with the metallograph, the spectrograph, the carbon determinator and many other marvelous research machines, they have paved the way for future metal progress. While giving metallurgists all the credit that is due them, let us not forget that the welding supervisor, the plant engineer and the actual welding operator have also supplied industry with a generous share of their know-how. Most of the streamlined procedures and new devices in this field have been introduced by these experienced men and women who put their practical minds to the solution of industry's practical problems.

Fig. 8—A suspended, counterbalanced gun reaches narrow openings

Fig. 9—Flash welding is also used at Ryan, to produce quality welds

★ MAINTENANCE

The Blacksmith Closed at Noon

BY HOWARD KEGLEY

A BRAWNY blacksmith at Arvin, Calif., learned, much to his regret, that there is such a thing as being too independent. It was the smith's habit to close up at noon Saturdays, come hell or high water. It lacked ten minutes of the hour one Saturday when a rancher drove up to get a gang-plow lever welded.

The smith said he was closing at noon, but would fix the lever on Monday. The rancher offered to pay him a bonus to fix it before quitting, explaining that at home the boys were plowing three shifts daily to get the dirt turned over before the fall rains set in. The smith did not even bother to argue—he merely pulled the door shut and clicked the padlock, ending the discussion abruptly.

E. O. Mitchell, the rancher concerned in the above incident, was annoyed, to say the least. He felt that he couldn't afford to be dependent upon such a stickler for closing rules as the blacksmith. "I'll do my own repair work hereafter," he muttered as he drove homeward.

STARTS IN A SHED

Mitchell and his eldest son rigged up a blacksmith shop in an old shed on the ranch. They sent back to Ohio for a welding outfit, and in a short time they were doing all their own shop work.

Neighbors who knew they were equipped to repair farm equipment soon began dropping in to have a sickle-driver welded or a broken clevis rejoined. The Mitchells at first helped them out as an accommodation, but it soon became too much of a burden for even a good neighbor to bear. The volume of work brought in became so great that they were compelled to employ additional mechanics and charge for the services.

Last year found them doing a blacksmith and welding business which grossed $200,000.* Meanwhile, the unobliging smith had asked them to buy him out, which they did, lock, stock and barrel. It would be interesting to speculate as to how much the smith received for the "good-will" of his business.

While all this was going on, another son of E. O. Mitchell graduated from the engineering department at Stanford University. After surveying the various opportunities offered, he decided that the best one was back on the farm. A wise decision, for the rural blacksmithing and welding shop today has 17,000 feet of floor space instead of the original 15 by 20 feet.

WHAT ONE MAN CAN DO

This astonishing example of real American initiative was the natural outgrowth of conditions and opportunities, coupled with the willingness of an enterprising American family to meet them more than half way. The Mitchells had migrated to the San Joaquin Valley in 1914, feeling that they could do no worse there than they had been doing on a tenant farm in the Mississippi Valley.

At first there didn't seem to be much difference, for the senior Mitchell had to hire out as a farm hand at $1.50 a day. Working on a huge dry-farming project near Bakersfield, he took such good care of his mules and got so much more work done as a result that the foreman put him in charge of mule conditioning and raised his daily pay to $2.50. Months later, the foreman got him a job with a threshing outfit at $3.50. At the close of the season, the thresherman backed him to rent and farm 160 acres of his own.

The energetic farmer took full advantage of the opportunity this start afforded and went on from there, his two strapping sons setting him a fast pace. The Mitchells leased and bought and farmed, never betting their all on any one type of product. Several times they got the break of large crops and high prices. That they still do some volume of farming is apparent from the fact that on their ranch they have a welded all-metal grain elevator which can load a carload of grain an hour, day in and day out. This elevator, incidentally, is available to the entire district.

FARMING IS BIG BUSINESS

Those whose experience with farms is confined to the garden plots of the east can scarcely appreciate that farming is big business in the San Joaquin Valley. Current ranch operations of the Mitchell family, for instance, embrace 260 acres of alfalfa, 322 acres of cotton, 40 acres of sorghum, 32 acres of vineyards, 12 acres of orchards, 1,263 acres of barley, 6,593 acres of wheat, 1,730 acres of summer fallow and 4,000

The late E. O. Mitchell, of Arvin, Calif., who founded a welding business when a blacksmith slammed the door on a Saturday forenoon

*Since this article was written, THE WELDING ENGINEER is advised of the death of E. O. Mitchell. His sons, however, are carrying on the business, which was clicking away in high gear according to last reports.

Because the local smith was unaccommodating in an emergency, a rancher and his sons started a welding business. Last year it grossed $200,000.

Located on a California ranch, this manufacturing establishment would do credit to any metropolitan area. Note the array of farm equipment waiting

acres of pasture. In 1944 they produced and marketed 525 bales of cotton at $57,750, 240 tons of cotton seed at $12,000, 2,080 tons of alfalfa at $41,000, 500 tons of sorghum at $5,000, 2,300 tons of wheat at $115,000, 500 tons of barley at $25,000, vineyard and orchard products totaling $16,000.

In addition to the products direct from the soil, their 270 dairy cows produced 51,600 pounds of milk, their contract baling and other services for farmers in the neighborhood amounted to another $28,000, and their income from contract work in leveling, grading and plowing farm lands for others brought in $90,000.

In their shops and on the ranch, the Mitchells employ from 60 to 140 helpers, depending upon the season of the year. Many of their agricultural workers have college backgrounds. Ambitious employees are given every opportunity to advance. One of the Mitchell sons conducts periodically a special school for training them to weld and do other general shop work.

From a blacksmith business originally confined to general repair work, one branch of the Mitchell shop has developed into a specialized enterprise. The Mitchells have learned from their own extensive experiences that almost any piece of farm machinery, no matter how well made, can be improved by minor adjustments or additions. For example, they discovered that they could increase the value of a certain type of seeder by two small, wide-tired wheels which follow the furrow and press the earth down firmly upon the seeds without packing the soil. These wheels are now cold pressed and turned out in volume. They wouldn't be worth a whoop in Illinois or Iowa, the Mitchells admit, but they are ideally suited to the whimsies of the San Joaquin Valley lands.

The Mitchells have also developed a lightweight welded cotton trailer which, local ranchers claim, will carry almost twice as many bales of cotton as the ordinary commercial trailer.

For years the Mitchells have done a great deal of contract work in land grading and leveling for irrigation. Before the war, they were turning out quantities of soil floats made chiefly of planks. Now they are manufacturing all-metal floats, which are spot welded throughout.

These are some of the specialties which do a particular farming job better and cheaper than it was ever done before. The Mitchells will tell you that welded farm equipment is strong and durable and that farmers are coming to understand and appreciate its many advantages. Needless to say, the advantages of quick welded repairs have long been known on the farm.

In less than 20 years this one American family has built up a business, including farming and blacksmithing, which grossed $640,000 in a single year. Which goes to show what an independent American farmer (who used to work for $1.50 a day) can do if he has a free rein.

Mitchell's original welding outfit is still in service in his big new plant (see picture at top of page)

The original Mitchell shop, located in an old shed, did all the ranch shop work and helped out neighbors

Fig. 1—General view of newly designed power shovel showing the welded tubular boom and dipper stick and all-welded outrigger box

Fig. 2 (middle picture)—Welding the boom point sheave unit to the tubular boom. The casting is fitted inside the tube before welding

Fig. 3—The mounting for the dipper stick, a saddle-shaped casting, is also arc welded to the boom

Photos courtesy The Lincoln Electric Co.

Welded fabrication of tubular assemblies save 40% in the manufacturing cost of a portable power shovel.

THE INCREASING trend to arc welding as a means of fabricating large machinery and equipment is indicated in the redesign of a portable power shovel developed by the Michigan Power Shovel Co., Benton Harbor, Mich. The new shovel, designated as Model T-6-K, has a capacity of ⅜ cu yd and is expected to have wide application in the industrial and construction fields. It is produced by arc weld-

Power Shovel Redesigned for Welding

BY R. D. LAYMAN

ing at a 40% saving over the previous design in which riveted connections predominated. Greater torsional stiffness is also provided because of the inherent rigidity and strength of welded construction.

Welded Tubular Assemblies

The new unit (see Fig. 1) utilizes the advantages of welded tubular design for both boom and dipper stick in place of the former angle and channel structures held together by riveting. In these two assemblies alone, welding made possible a saving in weight amounting to one third the weight of the original shovel.

In designing for welding, company engineers were careful to choose standard shapes and plates that would balance the amount of handling and welding required against the suitability of the material from both functional and appearance standpoints.

In the actual welding, the tubular assemblies are positioned for downhand welding. In fabricating the boom section, for example, the main tubular member is positioned so that it can be easily rotated to bring the joints in a flat welding position. The general method of positioning is brought out in Fig. 2.

Welding Castings to Boom

In Fig. 2, the operator is fusing the boom point sheave casting to the boom end. The casting is fitted inside the tube and butt welded without joint preparation. A dense bead with good penetration is obtained by using ¼-in. electrodes of AWS E-6012 specifications.

The saddle casting or dipper stick mounting is similarly welded to the central part of the boom (Fig. 3), using 5/16-in. electrodes of the same type for the fillet joints.

The hinge of the boom is slipped over the end of the tubing as shown in Fig. 4 and fillet welded solid to the tubing with the same ¼-in. electrodes used for the pulley casting. The scallops in the end of this casting were not placed there for ornament but to provide extra welding area for additional strength at highly stressed points.

The dipper stick consists of two lengths of tubing of smaller diameter than the boom tubing. These are connected by welding a cross member at one end as pictured in Fig. 5. This picture also shows how the gear racks are skip welded to the tubes. The gear racks are of cast alloy steel (SAE 3140). To fuse them to the tubes, seven intermittent weld beads approximately 5 in. in length are deposited along the joints on each side. A 10-in. fillet is deposited at the center to accommodate the extra load on the machine at this point.

Fig. 4—The hinge is slipped over the end of the boom and fillet welded. The scallops provide extra welding area to give additional strength

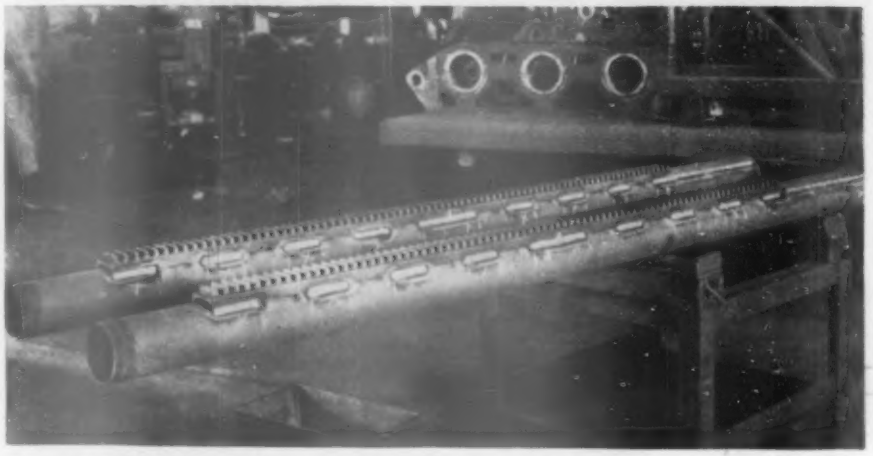


Fig. 5—The dipper stick assembly. The alloy-steel gear racks are joined to the two lengths of tubing by means of an intermittent welding technique

Welded Studs Step up Production

BY E. A. BONFIELD

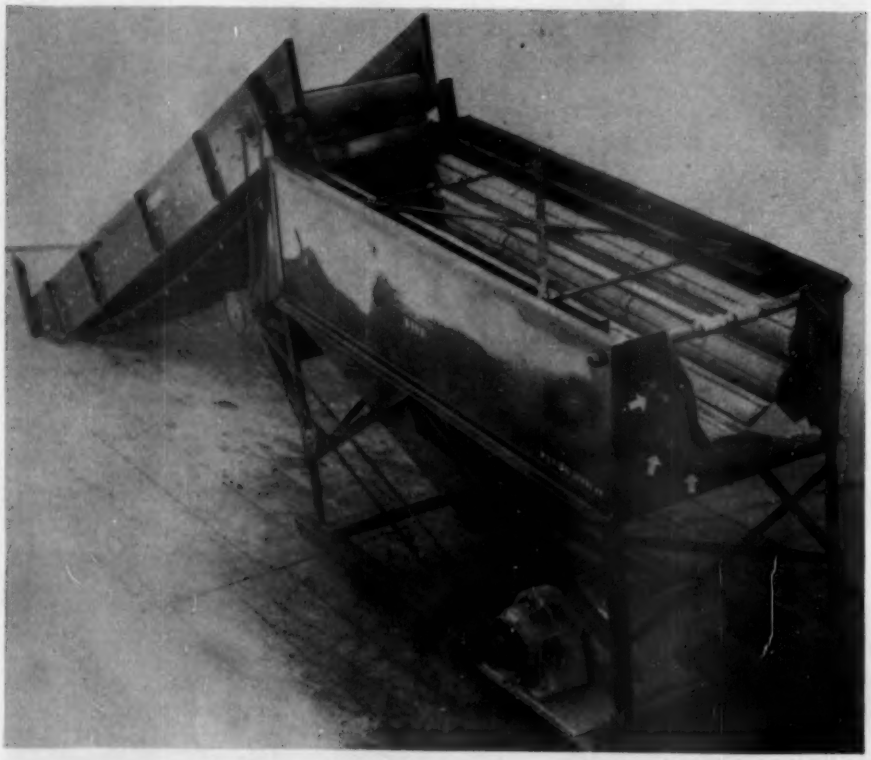


Fig. 2—The vegetable washing machine referred to in the caption for Fig. 1. Arrows indicate locations of the journal bearing studs. A similar end plate at the opposite side of the unit requires the same stud application

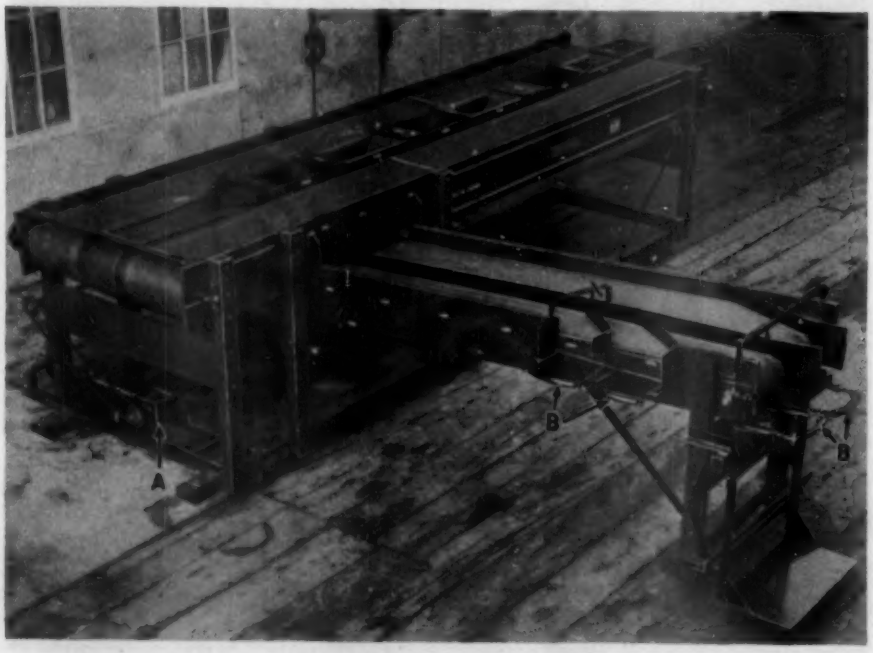


Fig. 6—The arrows indicate the locations of the stud-welded gear box (A) and the sack hooks (B) on a Paramount potato sorting and grading table

SPECIALIZING in the manufacture of vegetable processing equipment for canneries, the Paramount Manufacturing Co., Stockton, Calif., is more or less typical of the many plants who are being forced to step up production far beyond prewar levels. According to Joseph B. Schwab, owner and manager of the firm, and J. P. Stanley, assistant sales and office manager, Paramount faces a demand for its produce washing, grading, sizing and handling equipment that surpasses anything in the company's 20-year history.

More Men Not the Answer

Simply adding more men and more of the present types of equipment wasn't the answer, Paramount officials found. It took too long to obtain and install the equipment and to hire and train the workers. The only practicable way to increase production was to modernize production methods. As a result, redesigning was done wherever necessary in order to accomplish easier fabrication or improved product performance. It was also decided to investigate and purchase new types of immediately-available equipment including stud welders.

Standardization of designs for component parts and designing for welded fabrication to beat the foundry bottleneck on castings were the two first steps toward stepped-up production without added labor. The third step—the purchase of automatic stud-welding equipment—was undertaken after shop trials had indicated that this versatile process would permit substantial savings in fabricating time and cost.

Typical examples of stud-welding applications are illustrated in the accompanying pictures, reproduced through the courtesy of the Nelson Sales Corp. Fig. 1 shows Bob LeDoux, shop foreman, welding studs on end plates. These particular studs secure the bearing journals for the scrubbing roller shafts of a Paramount vegetable

Welded studs can be used to secure bearings on machinery or bent to make such things as handles and hooks. Whatever the application, they save production time.

Fig. 1—Bob LeDoux, shop foreman at Paramount Manufacturing Co., Stockton, Calif., welding studs to hold bearings on a vegetable washing machine

washing machine (Fig. 2). A watertight stud connection and a smooth interior surface are needed. These requirements were formerly met by drilling and countersinking the plate ¼ and 5/16 in. and inserting flat-headed ⅜-in. machine bolts, which were hand welded as sketched in Fig. 3. Stud welding does the entire job in one operation at the rate of 200 or more studs per hour.

The difficulty of obtaining castings dictated a change to welded design for the gear boxes used on several models of Paramount equipment. The old cast box required a total of 12 drilled and tapped studs for the three bearing journals plus four more drilled and tapped mounting holes in the base. The box is now stud welded (right of Fig. 4) at savings of 50% and more in time and labor. The handle for the cover is merely a large stud which is welded in place and then bent as shown in the picture.

Pointed Studs Make Hooks

A third important "production-increaser" accomplished through stud welding was the installation of sack hooks on Paramount bagging or sacking machines (left of Fig. 4). The hooks were formerly hand welded—a slow and costly process even with a good jig set-up. Now pointed studs are welded to the bar stock and then bent with a bending tool to the correct shape. The process is sketched in Fig. 5, and the location of both gear box and sack hooks on a potato sorting and grading table are shown in Fig. 6.

Several other applications of stud welding for fabricating and assembling angle-iron framework and sheet-steel side plates have also resulted in gratifying savings in time and cost. This is all to the good, for Manager Schwab still has the heat on Production Supervisor L. R. Smida and Purchasing Agent C. R. Ball to step up production to new highs.

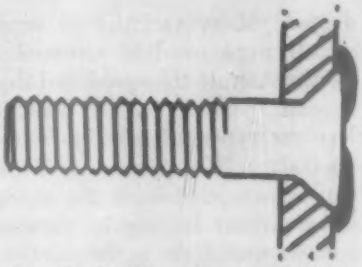


Fig. 3—Drilling, countersinking and manual arc welding were all needed in the old method of stud installation. Now only one operation is necessary

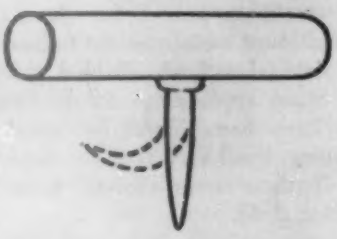


Fig. 5—Sketch showing method of making the bag holder hooks. Straight pointed studs are welded to the frame and then bent to the correct shape

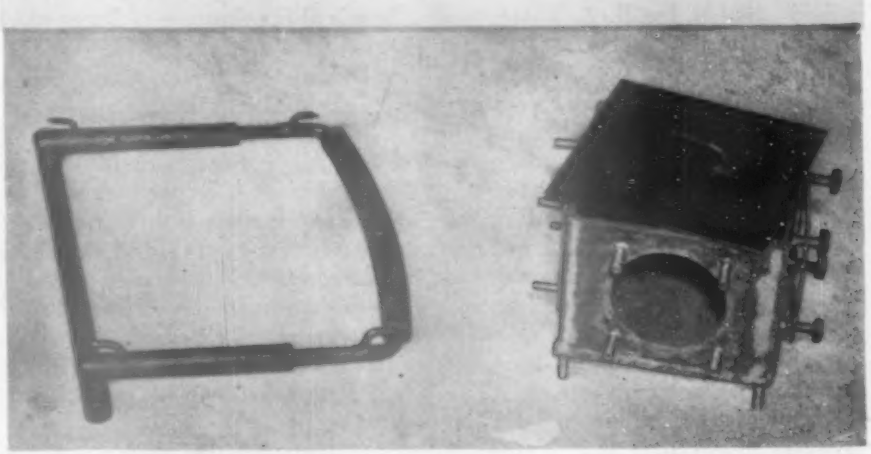
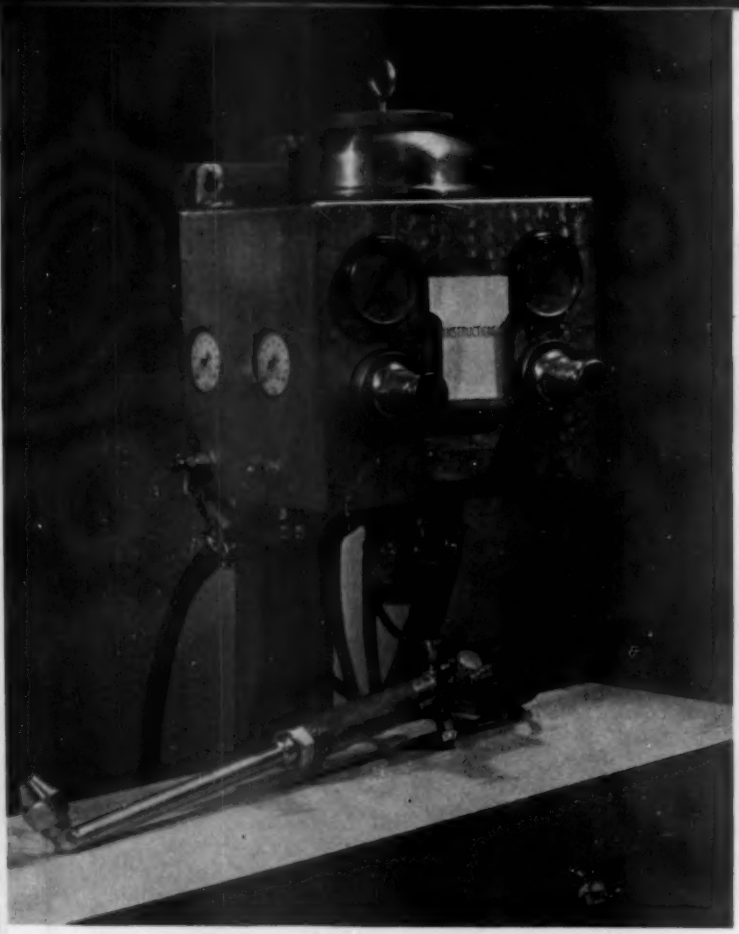


Fig. 4—Welded gear box (right) and bag holder. The old cast gear box required drilling and tapping for 16 studs, all of which are now welded in one operation. The handle is simply a large stud that has been bent down after welding, and the hooks on the bag holder are made in the same way



★ OPERATION

Powdered

Something of a sensation has been created by a new welding and hard-facing process in which powdered metal and fluxes are fed through the flame. Details are given here.

The equipment includes a torch, control box, regulating valves and a canister to hold the powdered metals

It has been known for some time that most metals can be reduced to the state of a finely divided powder, and many applications for this useful fact have been found by metal industries. Until very recently, however, all of these were remote from the welding field.

The "Powder Weld" Process

Fluxes have been fed through the welding flame for several years, but nobody thought of a practicable way of adding powdered metals to them—nobody, that is, but R. A. Wiese, now head of Powder Weld Inc., 419 Kent Ave., Brooklyn.

Mr. Wiese is the inventor of a new flame process for welding, brazing and hard-facing with powdered metals. The metal or alloy is mixed with its flux in a carefully predetermined portion and fed to the work through a flame generated and controlled by a preselected combination of oxygen with fuel and processing gases.

This development made its initial public appearance during the 27th National Metal Congress and Exhibition in Cleveland last February. Visitors to the Powder Weld booth were astounded by what they saw there. Demonstrations of welding with powdered metals and fluxes were conducted. Many varieties of superhard metals were overlaid on steel plates to demonstrate the speed and depth of deposit possible in a hard-facing. Various types of plastics were also applied . . . in fact, Inventor Wiese and his cohorts explained, the equipment is at present finding its greatest immediate usefulness in the plastics field.

Method Ahead of Materials

Unfortunately, there are as yet not so many powdered metals and alloys which may be used for welding, and there is also a shortage of fluxes which are suitable to being flame fed. The method, in other words, is running way ahead of its materials.

The situation is being corrected, of course. As far back as the time of the Metal Show at least one manufacturer of hard-facing alloys had announced an overlay especially suited to powder welding. Glints in the eyes of many rod and flux manufacturers as they walked away from the Powder Weld booth told the interested observer that thinking along these lines had already started.

Theoretically, the variety of materials which may be used in powder welding is limited only by: (1) the availability of the metal in powdered or finely fragmented form and (2) its stability in a flame. This leaves the field wide open for iron, copper, aluminum, magnesium, manganese, nickel, lead, tin, zinc, cadmium and silver . . . and for alloys of all these metals plus alloys containing beryllium, bismuth, boron, carbon, chromium, cobalt, molybdenum and tungsten. A wide variety of metallic oxides are also included. Thus it is probably only a question of time until powder materials have been developed to suit almost any kind of welding, brazing or hard-facing application.

Equipment and Gases

The equipment consists of a torch, control box with air and gas pressure-regulating valves and a canister from which the powdered materials are fed. All of these are shown in the accompanying picture. The torch, it will be noted, much resembles the ordinary welding torch in superficial appearance, but its special patented construction differs greatly from either a welding or a cutting torch. Different also are the three control knobs projecting from the handle. These knobs are part of the sixteen independent controls which make possible the precise regulation of all operating conditions.

The process ordinarily makes use of three gases: oxygen, a fuel gas and a cooling or processing gas. The fuel gas may be acetylene, hydrogen, butane, propane or any commercial natural or manufactured gas. The processing gas may be nitrogen, helium, argon or any more or less inert gas that is required to create a "con-

Metal in the Flame

BY CLYDE B. CLASON

trolled atmosphere" to meet specified conditions.

The mixture of flux and powdered metal is projected through the flame cone onto the work by means of the independently controlled processing gas. The independent sources of gas supply at the nozzle may also be used to introduce other modifying gases within the cone of the flame or around the outside. If desired, these gases can be made to carry liquid fluxing solutions by bubbling them through prepared solutions.

Many Controls Available

With this equipment, a skilled operator can achieve the following results:

Exact control of the amount of flux to be used with the metal or alloy. This is easy—the mixture is merely predetermined and accurately weighed before use.

Accurate control of the amount of mixture used per minute or per inch of weld or braze. This control is on the torch handle, right at the operator's fingertips.

Control at the torch handle of the flame temperature and atmosphere. This is done by regulating the fuel gas and oxygen mixture and by the addition of processing gas around the flame as desired. The processing gas is controlled independently of the fuel gas and oxygen.

Control of the temperature of the projected metal or alloy. This is achieved by employment of the handle controls mentioned in the preceding paragraph.

Control of the temperature of the target or work surface. This is readily effected by increasing or decreasing the flame and proportioning the processing gas and the material it carries. Both target and material temperatures are controllable all the way from "dry applications" similar to ordinary metal spraying to melting temperatures, which give, of course, the highest quality of bonding.

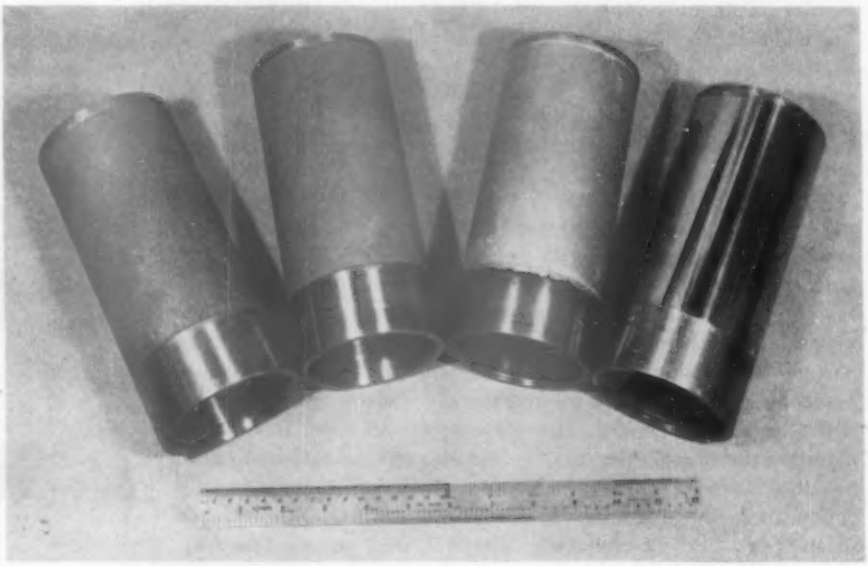
Welding and Brazing

Powder Weld equipment can be used with powdered metals and fluxes to do both welding and brazing. As previously explained, however, welding applications are restricted by the limited variety of powdered metals and suitable fluxes at present available. Using ordinary filler rods and fluxes, the equipment may be employed to weld or braze like any other torch plus the extra advantage of a controlled atmosphere at the point of deposit. The torch can also be used without the processing gas as a conventional welding or brazing torch, and its performance in this regard is said to be excellent.

As previously stated, Powder Weld equipment can be used by the plastics industry to apply such chemical compositions as polythene, some polyvinyls, some silicones and some elastomers. This is a rapidly expanding field. Glass-forming compositions such as silica and other frits resulting in enamels and glazed coatings can also be applied in the same manner.

As far as the welding industry is concerned, the greatest immediate opportunity for use of the Powder Weld process is in hard-facing. There are certain alloys so hard that hitherto it has been virtually impossible to make use of them. Powder Weld, its sponsors claim, applies these hard-to-handle alloys rapidly and economically, in any desired thickness. Everything from small tools to large steel machinery

Steps in the hard-facing of a pump sleeve by the powdered-metal method. Left to right: sleeve with undercut and blasted surface; sleeve with deposited overlay; sleeve after fusing deposit in controlled-atmosphere furnace; sleeve finish ground



Courtesy, Wall-Colmonoy Corp.

parts may be hard-faced by this new process.

Hard-Facing Process

A special hard-facing process that makes use of Powder Weld equipment has been developed by the Wall-Colmonoy Corp., Detroit. This process bonds sprayed metal particles onto a prepared surface and subsequently fuses the deposited particles to each other and to the base metal to produce a dense, wear-and-corrosion-resistant surface. A special nickel-chrome-boron alloy having a hardness of 56-62 Rockwell C is used in powder form.

The new part of this process, and the part in which it differs from conventional metal spraying, lies in the bonding of the sprayed particles at temperatures between 1,850 and 2,050 F. This renders it suitable for a wide range of surfacing applications for which metallizing could not be used because of the weakness of the bond.

The first step necessary in applying an overlay by this method is to undercut the surface to the proper amount. In a plug gauge, for example, the base metal should be undercut 1/32 in. on the diameter so that when the gauge is finish ground there will be a 1/64 in. layer of hard-facing alloy remaining.

Step No. 2 is to grit blast the undercut surface with medium steel grit. Blasting is necessary, as in metallizing, in order to obtain a mechanical bond to hold the sprayed metal in place until a fusion bond has been established. However, the steel grit may be smaller than that ordinarily used to prepare a surface for metallizing, and the blasting is carried on only long enough to remove the surface luster. It is desirable to flame spray the blasted surface as soon as possible after preparation, before an oxide film has a chance to form.

Plastic-Coated Filler Rod

Flame spraying, the third step in this new overlaying process, may be done with either the Powder Weld torch tool system or with a metallizing gun using a special prepared rod of the nickel-chrome-boron alloy. The latter rod is made by pressing the powdered metal with a plastic binder. In passing through the flame, the plastic burns away completely, leaving no residue to contaminate the overlay. The burning plastic produces a reducing atmosphere, which surrounds the sprayed metal particles and thus keeps oxidation to the minimum. Since this type of rod is available only in 1/8-in. diameter and 3-ft lengths, the operator must be watchful to attend the gun constantly. Less air pressure is required to spray the plastic-bonded rod than is required for ordinary metallizing wire of the same diameter. This is because the metal particles are already in finely divided form and it is not necessary to atomize them by means of a high-velocity stream of air.

Whether metallizing or Powder Weld equipment is used for spraying, it is necessary to adjust the gases so as to obtain a light gray deposit. Ordinarily, a coating 1/32 in. thick is sufficient as this allows 1/64 in. to be removed in finishing and leaves 1/64 in. of overlay on the work. In cases where the alloy is applied chiefly for corrosion resistance, a layer 0.005 to 1/64 in. thick is generally sufficient if no finish grinding is necessary.

Shrinkage to the extent of 15 to 20% of the overlay depth occurs during the bonding operation, and it is always necessary to allow for this when coating parts which must be finished to a specified dimension.

Methods of Bonding

The final step in the process is the bonding of the sprayed particles to each other and to the parent metal. This may be done with either the Powder Weld torch or an ordinary welding torch if there are only a few small, flat pieces to be bonded. If the coated article is large and flat, however, or if there are a large number of small pieces to be bonded, it will be more economical to use a controlled-atmosphere furnace. With cylindrical pieces, an induction heater may be used to good advantage.

The temperature required for bonding is approximately the same in every method, that is from 1,850 to 2,050 F. Temperatures on the low side can be used when bonding is done in a furnace in an atmosphere having a high hydrogen content. Temperatures on the high side are needed, however, in ordinary brazing furnaces with cracked gas atmospheres. The optimum bonding temperatures for the welding torch or the induction heater may be easily found with a little experimentation.

If the preparation, spraying and bonding operations have been properly done, the resulting overlay will have a smooth, shiny surface and a hardness testing 55 to 60 Rockwell C scale. Because of the thin overlay obtained by this process, it is necessary to take hardness readings on the Rockwell A scale and then convert them to the C scale.

Bonding is made possible by the formation of an alloy of the base metal and the lower-melting constituents of the hard-facing. Photomicrographs also reveal a penetration into the base metal, which may extend for some distance, especially in the case of cast iron.

With proper processing, there will be obtained a fused bond which holds the overlay to the base metal under all conditions of service. And the sprayed and bonded deposit will have the same resistance to wear, corrosion and galling of the cast or torch-welded alloy.

"Welded" Has Sales Appeal

MR. and Mrs. John Q. Public prefer to buy welded products and will respond gratifyingly to the use of that word in advertisements. And the further description, "electronically welded," has true word magic to boost sales, thinks the advertising department of a large and prosperous Chicago department store.

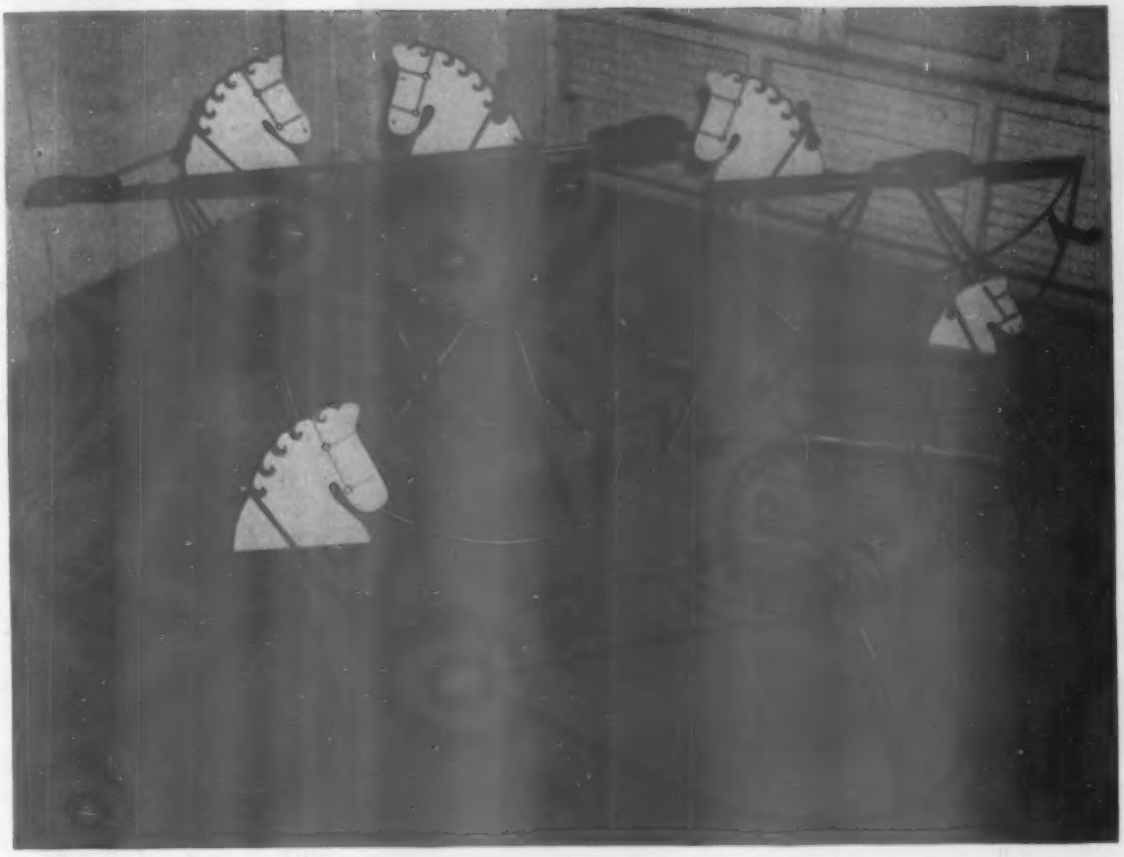


Fig. 1—Welded hobby horses, teeter-totter and baby walker manufactured by Houck Bros., Los Angeles. Their steel frameworks are sufficiently rugged to stand up under Junior's Commando tactics

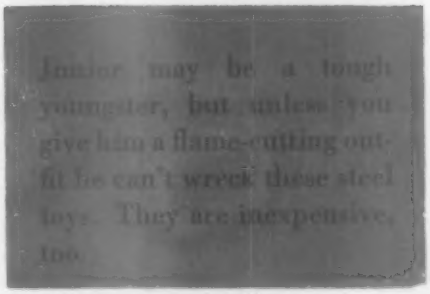
All-Welded Steel Playthings

BY FRED M. BURT

ONE factor common to most playthings is that they are not very rugged. Come next Christmas, Junior's pride and joy of the year before is quite wobbly or but a memory. The young man has the capacity and inclination to make himself a vigorous testing unit, with the ability to apply an ingenious variety of stresses and impacts.

Toys That Can Take It

But when Junior and his playmates apply their collective playful vigor to the strenuous treatment of all-steel welded playthings, their parents are due for a surprise. These toys will stand the gaff and are most likely to stay whole and in good working condition even unto the next generation.



Prime examples of playthings or toys employing the welded technique in their manufacture are the teeter-totter, hobby horses and baby walker shown in the process of final development, Fig. 1. These are products of Houck Brothers, toy manufacturer of Los Angeles. The larger hobby horse has an overall length of 36 in., the teeter-totter one of 63 in. Height to the seats is 16½ in.

With supplies of steel again becoming available in any form desired, it may be expected that many more playthings will be designed for manufacture by welded fabrication. In addition to greatly added durability and easy adaptation to nearly any type of design, the cost factor is decidedly favorable, even for comparatively small quantities. Also, as will be further outlined, the jigs and fixtures required are relatively simple and inexpensive.

Construction of Rocker

The lower rocker part of both the teeter-totter and hobby horse is con-

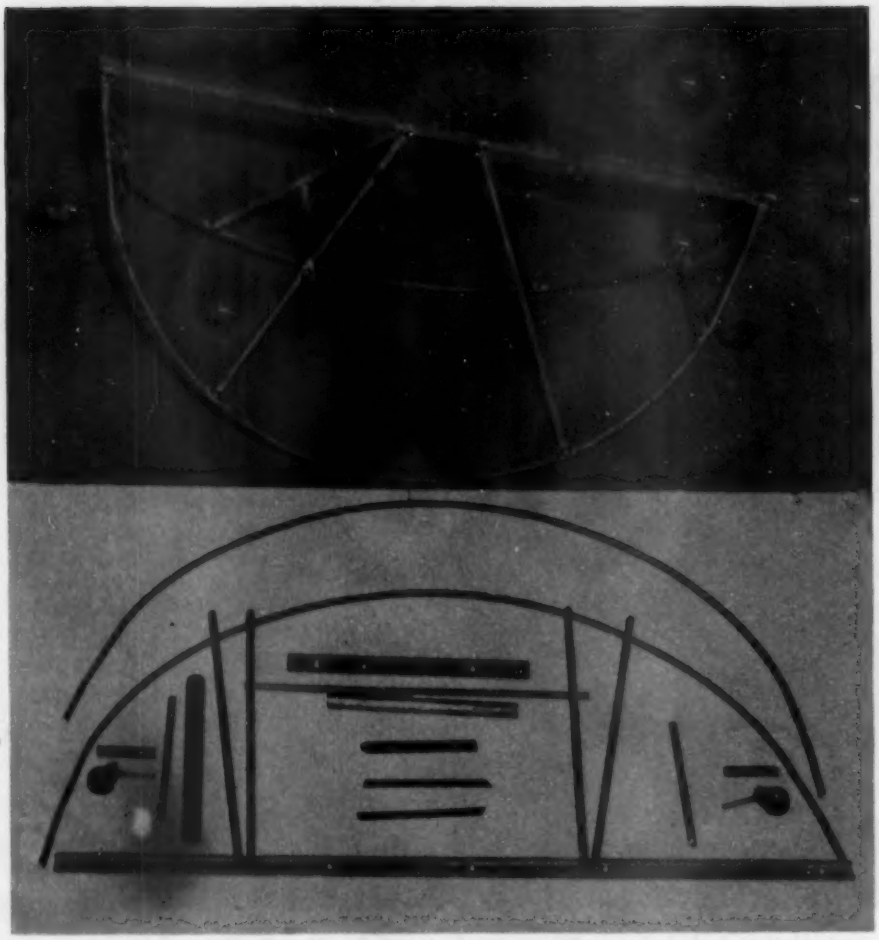


Fig. 2—The same rocker arm is used for both the hobby horse and the teeter-totter. Below are the 14 parts from which the rocker unit is made

structed from 14 parts (see Fig. 2). The top of the welded unit is a steel channel measuring 1 by ⅜ by ⅛ in. Holes are punched in the channel for attachment of the seat or seats and head brackets.

The rockers and the four supports running up to the center part of the channel are cut from ⅜-in. mild-steel rounds. The foot rest (two rests on the teeter-totter) is also made from ⅜-in. steel rod and welded to the supporting rods. The castors at each end are inserted in and welded to short lengths of ¼-in. pipe, which, in turn, are welded to crosspieces of ⅜-in. rod.

The head bracket is made from six pieces which are shown in the center of the lower part of Fig. 2. The bracket's base is a piece of channel, 1 by ⅜ by ⅛ in. and measuring 11 in. long. A bolt is welded to it to permit the bracket to be bolted to the main channel. The other components of the head bracket are two steel bars 0.062 by ½ in. by 6 in. long, another 6-in. length 0.062 by ¾-in. and the handle-bar. The latter is a ¾-in. tube, 9 in. long, with its rough ends protected by rubber caps.

A piece of 1-in. steel rod, 8 in. long, is welded to the underside of the main channel, back of the seat, to counterbalance the head and head bracket and keep the hobby horse level when not in use. This is not necessary on the teeter-totter. The latter toy has a second head assembly and a double seat assembly, the seats being bolted to 1 in. steel tubing 26 in. long.

Cutting and Welding

All heavier parts are cut to size from 20-ft and 30-ft lengths of stock on an abrasive cut-off (Fig. 3), using an 18-in. diameter by ⅛-in. abrasive disc. Bar stock is cut on a small hand shear. The cut-off disc leaves a minimum of burrs, which, on small parts, are removed in a tumbling barrel. On the larger parts, excessive burrs that will not burn away in welding are ground down with a pedestal grinder.

Working at capacity, more than 140 of these toys can be completed daily in one eight hour shift. The work is done in six welding booths, each 7 by 8½ ft, equipped with four standard makes of a-c welders having ratings of from 150 to 200 amp. Most of the welding is done with $\frac{3}{32}$ in.

Fig. 5—Welding a castor subassembly. On the same table to which this jig is attached is the revolving jig used to weld the head brackets

E-6013 (all-position) electrodes with ⅛-in. coated electrodes for chrome-moly steel being used for the poorer fits where more fill is required.

Jig for Main Assembly

All of the parts of the main assembly are placed in one jig (Fig. 4) and are held by eight aviation-type toggle clamps. The jig revolves in a pipe base and can be set in any position in a 180-degree arc. It also turns on its horizontal axis and so can be tipped from side to side for accessibility in welding. The assembly is placed on one side, and welds are made in ten positions; then it is turned around and placed on the other side of the jig for ten more welds, followed by two welds on the inside on each end in the upright position. Loading, welding and unloading take about 12 minutes per assembly.

The last four welds mentioned are to attach the castor subassemblies, the fabrication of which is shown in Fig. 5. The cross rod and castor-holding pipe are held in position in a vise, and the weld is made on one side. The subassembly is next turned completely over, and a weld is made on the other side through a hole in the vise-holding plate. The castor is then inserted and welded to the pipe. This welding in three positions can be done at the rate of about 35 units per hour.

The head bracket welding jig is also shown in the same picture (Fig. 5). This jig revolves on the base plate for easy accessibility to five welding positions. Twenty head brackets per hour is a normal production.

Previous Production Method

Many improvements have been made since Houck Brothers purchased the plant from the California Aircraft Welding Company. Steel tubing was used instead of ⅜-in. rod in the first toys. Though offering weight advantages, the tubing was more difficult to weld and was subject to blowholes, which did not show up until the pickling prior to painting. The rod is also easier to restore to shape if the completed unit happens to be subjected to heavy pressure or severe impact that will cause distortion.

As evidence of the progress that has been made, it is interesting to compare the old and new procedures. The old method of production followed this procedure:

(1) Tacking was done in the placing jig in six positions on each rocker.

(2) The castor subassemblies and foot rest or rests were tacked on in another jig.

(3) Finish welding was done in a third jig.

Fig. 4—Jig for the main subassembly. It revolves in its pipe base, can be locked in any position in a 180-deg arc. It can also be tipped vertically

Fig. 3—Abrasive cut-off for steel stock. Here Manager Rollie Houck is using it to cut a ⅜-in. rod

(4) Castor subassemblies were tacked together without the use of a jig. Production was slow and non-uniform.

(5) The head bracket assembly alone was welded by the present method.

Final Steps

Any additional grinding and buffing required is done on motor-driven grinder. The assemblies are then degreased, pickled, painted and decorated. Decorations on the wooden heads is applied by the silk-screen process. After final inspection, the parts are wrapped and packed. The head assemblies and seats will be attached with bolts by the recipients—a nice job for Father on Christmas Eve.

This small plant of 3,200 sq ft floor space is used also for welding job work. Its equipment includes a Heliarc welding outfit, an oxy-acetylene cutting torch and six welding torches, a portable flexible-shaft grinder, three drill presses, a punch press, work benches, storage racks, cleaning, pickling, painting and decorating equipment. Supplies or materials in transit are handled in four-wheeled, deep dolly trucks 30 by 30 by 30 in. These were fabricated from welded tubing and lined with sheet steel.

In comparison with the dollar value of its capacity production, the capital investment of this plant is remarkably low. The story of these welded playthings that Junior can't break should suggest some good ideas to other small (or even large) businesses.

★ OPERATION

A-C Welding Status in 1946

★ Part One—The present favorable status of a-c welding is due to a number of factors, thinks this author, not the least being the development of superior equipment and electrodes.

BY ORVILLE T. BARNETT

Production Engineer, Welding Div., Metal & Thermit Corp.

HISTORY shows a-c welding being used as a repair process as long ago as World War I. But it did not share in the rapid growth of the metal-arc process in general that occurred between the two major world wars, largely because of the lack of a-c arc stability. The bare or lightly coated types of electrodes on the market in the early days of arc welding greatly restricted the use of a-c welding.

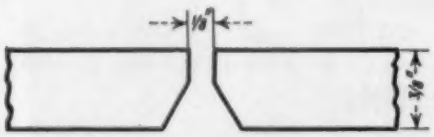


Fig. 1—Typical gapped seam designed to reduce chipping in welded pressure vessels of ASME U-69 type

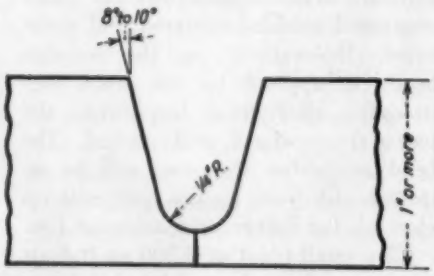


Fig. 2—U-groove for heavy plate

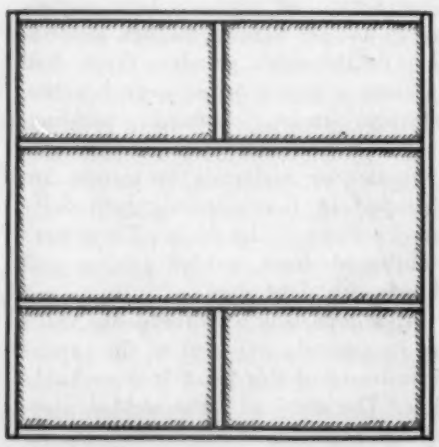


Fig. 3—Plan of machine base with many corners to be fillet welded

E-6010 Favored D-C

This was also true of the first heavily coated electrode, the AWS E-6010 type, which exhibited its best operating qualities with direct current, reverse polarity. This all-position electrode has been enormously popular, enjoying a greater sale than all other electrode types combined, and its preeminent position remained unchallenged throughout the war period. Postwar sales, however, indicate that the E-6010 electrode is now losing ground to the all-position E-6012 and E-6013 types, while E-6020 electrodes are continuing to gain in applications in which the work can be positioned. It is significant that the E-6012, E-6013 and E-6020 types are all suitable for a-c welding.

From the early thirties until the present, the growth of a-c welding has steadily continued in large fabricating plants. This has not been equally true of small shops because too many welding jobs were outside the scope of operations of the early a-c welding. As late as the beginning of the war, a small shop might have been restricted to the selection of a d-c welder only. But a big change in the situation was effected by the war, the War Production Board and hard-working electrode designers.

The WPB favored a-c equipment because less critical materials were required in the fabrication of a welding transformer than in a motor-generator set. The widespread war applications of a-c welders quickly led to a swelling chorus of demands for more a-c electrode types. Among the war babies was the E-6011, the a-c twin of the popular E-6010 type. An even more spectacular accomplishment was the introduction of a complete line of a-c/d-c stainless electrodes.

A-c welding enthusiasts belong to the chicken-or-the-egg school of debaters. Electrode manufacturers claim that the rebirth of a-c welding was made possible because of such electrodes as the E-6012, E-6013 and E-6020 grades. On the other hand, transformer manufacturers claim that the increased application of a-c welding resulted in the new electrode types and thereby increased the sales of electrodes. As with most arguments, there is truth on both sides.

A detailed review of the reasons for using a-c welding processes will now be undertaken. To be entirely fair, deficiencies as well as advantages will be reported.

The four principal advantages claimed for a-c welding are: (1) freedom from magnetic blow; (2) increased production; (3) low power consumption and (4) low cost maintenance. Of these four, FREEDOM FROM MAGNETIC BLOW deserves to be printed in capital letters as it will come up again and again.

A Magnetic Tempest

Most welding engineers are familiar with the troubles caused by arc blow, but the weldor can give the best—and properly profane—discussion of this topic. "Blow" is not a misnomer as the magnetic forces whip the molten pool

Courtesy, Ross Heater Mfg. Co., Inc., Buffalo

The shell for this 27,500 sq ft surface condenser was welded with a-c equipment using E-6020 electrodes. Because of the many corners involved and the high amperages employed, arc blow would otherwise have been a bad problem

and liquid slag in much the same manner as the wind creates waves. Under severe conditions of arc blow, it is virtually impossible to produce a weld of good internal quality or neat external appearance.

With d-c welders, the influences of arc blow can be minimized in several ways such as changing the location of the ground, reversing the direction of welding, welding end dams at the extremities of joints and using permanent or electromagnets. All of these require time. Where the weldor is paid by the hour, management pays good money for the time he must spend in relocating grounds. Where payment is made on a straight piecework basis, it is the weldor who is penalized for the effort he expends in counteracting arc disturbances.

A-c welding, it must be emphasized, does not mean the complete elimination of arc disturbances. However, the reduction in interference is so striking as to be responsible for the claim that all of the blow is gone.

Arc blow has proved especially difficult in five particular applications: (1) gapped seams in lighter sections; (2) ends of straight runs in deep-groove welding; (3) fillet welds involving corners; (4) deep-fillet welding and (5) the ends of straight runs of horizontal fillets. A brief discussion of each of these will be given.

Welding a Gapped Seam

Fig. 1 illustrates a gapped seam designed to reduce the amount of back chipping required for ASME U-69 pressure vessels. To secure the utmost labor-saving advantage from a joint design of this type, uniform penetration of the first bead deposited in the grooved portion is essential. The first welding run is made in the flat position while the shell is rolled through 180 deg.

The gap creates extreme magnetic blow with d-c, but a-c welding with E-6011 electrodes provides excellent penetration undisturbed by magnetic forces. After the first bead has been laid, a light chipping or gouging operation is completed. The weld is then finished with a single run. Not only is chipping less costly, but the weld metal is of X-ray quality and the welding time is also reduced.

Deep U-Grooves

Magnetic disturbances at the ends of the seam are quite pronounced where straight runs of deep U-grooves (Fig. 2) are being welded. One accepted method of combating the blow is to weld end dams to the outside edges of the joint. Welded all around, these dams provide a receptacle for the liquid steel and a path for the magnetic forces. However, production time and effort must be devoted to combating magnetic blow instead of to the deposition of weld metal.

With deep grooves, a-c welding provides two definite advantages observable in X-ray and in cost studies. The X-rays reveal that the ends of the seam exhibit the same high quality as the center of the weld. Time-study records show that less production time is consumed with blow-free a-c welding.

Corners and Deep Fillets

Units such as heavy machine bases (Fig. 3) and press frames can hardly be constructed without corners—a prolific source of arc blow. The intensity of magnetic forces is a function of the amperage of the current, which explains the greatly magnified effects of arc blow when large-diameter electrodes are being employed at high-current values. Frequently, the forces of magnetic blow become so violent in a corner that a truly herculean effort is required to overcome them in d-c welding. These same forces, however, are quite docile with a-c.

The gospel of the deep-fillet procedure was given considerable emphasis during the war period when there were many newcomers in the field of heavy welded construction. In this technique, the influence of arc blow took the form pictured in Fig. 4. In Sketch A, magnetic effects prevented the arc from digging into the root of the fillet. Sketch B depicts the relatively deeper penetration that is obtained without magnetic interference. Penetration in deep fillets is sometimes facilitated by a small, controlled gap utilizing spacers. In such cases, the importance of minimizing magnetic fields becomes all the more important.

Arc Blow at Ends

Anyone who has ever welded straight runs of horizontal fillets like the one shown in Fig. 5 has an unforgettable impression of the troubles arc blow creates at the beginning and end of each weld. A-c corrects the unfavorable condition, thereby improving the appearance of the weld at both ends and increasing the speed with which the metal can be deposited.

So far this discussion has been largely directed at heavy fabrication, but the use of a-c welding on sheet

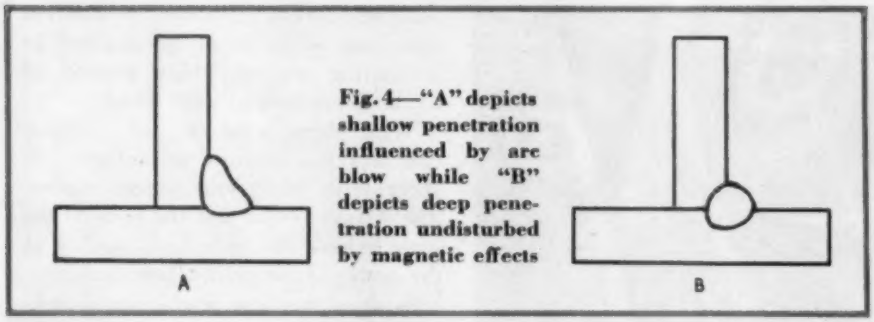


Fig. 4—"A" depicts shallow penetration influenced by arc blow while "B" depicts deep penetration undisturbed by magnetic effects

metal and light-gauge aircraft tubing should not be overlooked. E-6013 electrodes were originally developed for the low open-circuit voltages needed in such applications. Additional arc stability has been furnished in some welders by superimposing high frequencies on the normal a-c frequency. Better striking characteristics in the welding of thin metals, quick arc recovery and special equipment to fill craters have also been provided.

That Safety Angle

Where weldors have been accustomed to d-c, a resistance to changing to a-c will be encountered. Very often this resistance will be reinforced by the feeling that a-c units are less safe than d-c equipment. Let's look into that question for a minute.

Electrical and safety engineers know that alternating current has a greater physiological shock effect upon the human system than direct current of comparable voltage. However, the sharper bite of a-c tends to make the weldor a bit more safety conscious than he is with d-c, and the average weldor is more careful when he is doing a-c welding.

Welding is not inherently a hazardous occupation. True, men have been killed with both a-c and d-c welding equipment. In every case, however, extreme carelessness was responsible. When a-c welders are used under the proper conditions, the record shows a high degree of safety. To wear sweat-soaked clothes in restricted spaces is about as hazardous as to play with the light switch while standing in the bathtub at home.

Considerable emphasis was placed for a time on using a-c transformers at lower open-circuit voltages. This may be satisfactory on light work, but heavy work needs the higher voltages. Human care and proper safety devices are the true answer.

Current Adjustments

Two types of current selection are available in a-c welders. The plug-in type uses a series of resistors to provide current increments, eliminating the use of handwheels and moving parts. "Stepless" current selection, the second method, usually is accomplished by means of a movable coil. The later machines incorporating the stepless arrangement are more easily adjustable than the early types were.

With regard to operating costs, transformers consume very little current while idle as compared with the current that is needed to keep a motor-generator set turning. Since idle time may be as high as two thirds of the total operating time of the equipment, this fact well merits consideration. Efficiencies of power use are high in a-c welders, but power factors are poor. The latter condition is corrected through built-in capacitors or by adding condensers to the main plant power lines. Leading power factor correction is, in fact, possible, thereby offsetting some of the normal power factor penalties of the many induction motors found in most plants.

Usually, a-c welders are of greater rated capacities for comparable applications, particularly in the sizes required for heavy work. Thus a 500-amp a-c welding transformer is comparable to a 400-amp d-c welder.

Less Maintenance

A-c welder maintenance costs are less than d-c equipment because of the absence of moving parts (other than cooling fans and bearings for current-adjusting mechanisms). Brush maintenance and bearing inspection are unnecessary. For these reasons, a regular overhaul of a-c equipment needs to be done at rather infrequent intervals compared with the maintenance programs for d-c machines.

To summarize, the reasons for using a-c include: less arc blow, greater production welding speeds, more efficient use of current and lower maintenance costs. Disadvantages include the inability to weld a few non-ferrous materials, a possibly greater shock hazard and the need for power factor correction and proper distribution of the single-phase welding load. Also the use of safety devices to create low open-circuit voltages while the arc is inoperative tends to slow production. All in all, the advantages outweigh the disadvantages, as is evidenced by the steady increase in a-c welding applications throughout industry.

The second part of this article, to be published in the July issue, will be devoted to the many electrode types available to users of a-c welding.

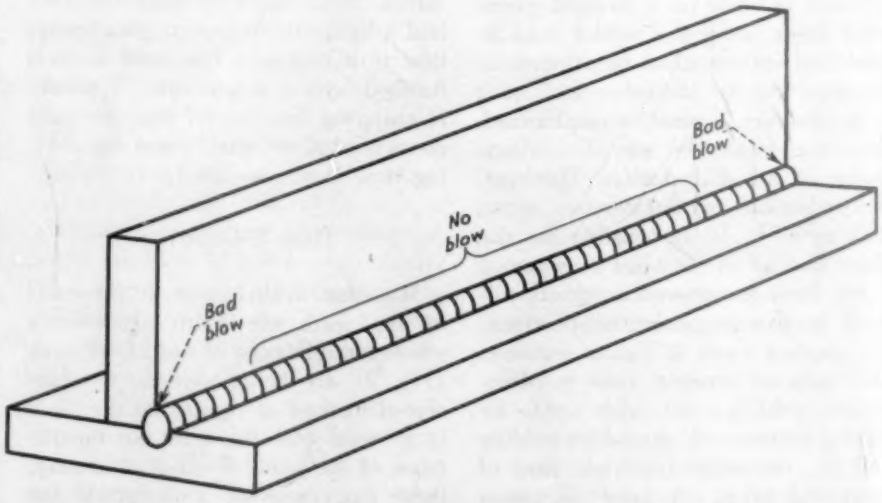


Fig. 5—How arc blow occurs at the two ends of horizontal fillet welds

★ RESEARCH

Steel for Petroleum Piping

BY R. J. PASS

Tempil Corporation

The selection of the proper steel for a particular piping application is extremely important. This article gives the compositions and properties of steels in the different groups and tells how they may best be welded.

THE STANDARD steel compositions commonly used in the petroleum and chemical industries for tubing and piping are well defined by various specifications of the American Society for Testing Materials and other technical organizations. The commonly encountered steels are separated into groups according to their composition and properties. It is the purpose of this article to discuss the relation of the constituents to the properties of the steels, as well as their suggested uses and fabrication and welding characteristics.

These steels may be divided into ten groups:

1. Ordinary low-carbon steels
2. High-tensile strength steels
3. Sub-zero steels
4. Carbon-molybdenum steels
5. ½% chromium, ½% molybdenum steels
6. 2% chromium-molybdenum steels
7. 4-6% chromium-molybdenum steels
8. 9% chromium, 1% molybdenum steels
9. 12% chromium steels
10. 18% chromium, 8% nickel steels

Low-Carbon Steels

This group is the most common and the least expensive of all the steels since it contains no special alloying elements. These steels depend primarily on carbon and manganese for their strength; the former element is usually held below 0.25% and the latter below 1.00%. Tensile strength will ordinarily vary between 55,000 and 70,000 psi.

While resistant to a great many types of chemicals and atmospheres, low-carbon steels possess the least corrosion resistance of all the steels. They harden only slightly when cooled from above the critical range, that is from above 1,575 F. However, they are easily fabricated and do not usually require preheating except when the carbon is on the high side, the sections are heavy, or the atmospheric temperature is low. Under these conditions, preheating temperatures in the range

Table 1. Metals Preheating Chart

METAL GROUP	METAL DESIGNATION	C.	RECOMMENDED PREHEAT
PLAIN CARBON STEELS	Plain Carbon Steel	Below .20	Up to 200°F
	Plain Carbon Steel	.20-.30	200°F-300°F
	Plain Carbon Steel	.30-.45	300°F-500°F
	Plain Carbon Steel	.45-.80	500°F-800°F
CARBON MOLY STEELS	Carbon Moly Steel	.10-.20	300°F-500°F
	Carbon Moly Steel	.20-.30	400°F-600°F
	Carbon Moly Steel	.30-.35	500°F-800°F
MANGANESE STEELS	Silicon Structural Steel	.35	300°F-500°F
	Medium Manganese Steel	.20-.25	300°F-500°F
	SAE T 1330 Steel	.30	400°F-600°F
	SAE T 1340 Steel	.40	500°F-800°F
	SAE T 1350 Steel	.50	600°F-900°F
	12% Manganese Steel	1.25	Usually not Required
HIGH TENSILE STEELS (SEE ALSO STEELS BELOW)	Manganese Moly Steel	.20	300°F-500°F
	Manten Steel	.30 Max.	400°F-600°F
	Armco High Tensile Steel	.12 Max	Up to 200°F
	Mayari R Steel	.12 Max.	Up to 300°F
	Nax High Tensile Steel	.15-.25	Up to 300°F
	Cromansil Steel	.14Max.	300°F-400°F
	Corten Steel	.12 Max.	200°F-400°F
	Yoloy Steel	.05-.35	200°F-600°F
NICKEL STEELS	SAE 2015 Steel	.10-.20	Up to 300°F
	SAE 2115 Steel	.10-.20	200°F-300°F
	2½% Nickel Steel	.10-.20	200°F-400°F
	SAE 2315 Steel	.15	200°F-500°F
	SAE 2320 Steel	.20	200°F-500°F
	SAE 2330 Steel	.30	300°F-600°F
	SAE 2340 Steel	.40	400°F-700°F
MEDIUM NICKEL CHROMIUM STEELS	SAE 3115 Steel	.15	200°F-400°F
	SAE 3125 Steel	.25	300°F-500°F
	SAE 3130 Steel	.30	400°F-700°F
	SAE 3140 Steel	.40	500°F-800°F
	SAE 3150 Steel	.50	600°F-900°F
	SAE 3215 Steel	.15	300°F-500°F
	SAE 3230 Steel	.30	500°F-700°F
	SAE 3240 Steel	.40	700°F-1000°F
	SAE 3250 Steel	.50	900°F-1100°F
	SAE 3315 Steel	.15	500°F-700°F
	SAE 3325 Steel	.25	900°F-1100°F
	SAE 3435 Steel	.35	900°F-1100°F
	SAE 3450 Steel	.50	900°F-1100°F
MOLY BEARING CHROMIUM AND CHROMIUM NICKEL STEELS	SAE 4140 Steel	.40	600°F-900°F
	SAE 4340 Steel	.40	700°F-900°F
	SAE 4615 Steel	.15	400°F-600°F
	SAE 4630 Steel	.30	500°F-700°F
	SAE 4640 Steel	.40	600°F-800°F
	SAE 4820 Steel	.20	600°F-800°F
LOW CHROME MOLY STEELS	2% Cr.-½% Mo. Steel	Up to .15	400°F-600°F
	2% Cr.-½% Mo. Steel	.15-.25	500°F-800°F
	2% Cr.-1% Mo. Steel	Up to .15	500°F-700°F
	2% Cr.-1% Mo. Steel	.15-.25	600°F-800°F
MEDIUM CHROME MOLY STEELS	5% Cr.-½% Mo. Steel	Up to .15	500°F-800°F
	5% Cr.-½% Mo. Steel	.15-.25	600°F-900°F
	9% Cr.-1% Mo. Steel	.15 Max.	600°F-900°F
PLAIN HIGH CHROMIUM STEELS	12-14% Cr. Type 410	.10	300°F-500°F
	16-18% Cr. Type 430	.10	300°F-500°F
	23-30% Cr. Type 446	.10	300°F-500°F
HIGH CHROME NICKEL STAINLESS STEELS	18% Cr. 8% Ni. Type 304	.07	Usually Do Not Require Preheat But It May Be Desirable to Remove Chill
	25-12 Type 309	.07	
	25-20 Type 310	.10	
	18-8 Cb. Type 347	.07	
	18-8 Mo. Type 316	.07	
	18-8 Mo. Type 317	.07	

NOTE: This chart shows recommended Preheat temperatures for Welding. In hard-facing, preheat temperatures higher than indicated are sometimes required depending on size and shape of the part and the type of hard-facing alloy to be applied.

PRE-HEATING PRIOR TO WELDING WILL

1. Eliminate the danger of formation of cracks.
2. Reduce distortion.
3. Reduce or prevent Shrinkage Stresses.

THE NEED FOR PREHEATING INCREASES AS THE FOLLOWING FACTORS ARE CHANGED.

1. The larger the mass being welded.
2. The lower the temperature of the pieces being welded.
3. The lower the atmospheric temperature.
4. The smaller the weld rod in diameter.
5. The greater the speed of welding.
6. The higher the Carbon content of the steel.
7. The higher the Manganese content.
8. The greater the Alloy content in air hardening steels.
9. The more the air hardening capacity of the steel.
10. The more complicated the shape or section of the parts.

Courtesy Tempil Corp. (Copyrighted 1941)

Courtesy, Tube Turns, Inc.

Welding fittings such as the tee and elbows pictured greatly simplify welded pipe installations in oil refineries and chemical plants

of 150-300 F are recommended. When welded joints are to be subjected to the more severe types of service, stress relieving at 1,100-1,200 F for one hour per inch of thickness is advisable.

This ordinary type of steel may be selected when exposure to corrosion is not severe, when the operating temperature is not too high and where an inexpensive metal is required.

High-Tensile Steels

A number of compositions are available to the metal user in which steels with tensile strengths of from 70,000 to 100,000 psi are produced by varying small percentages of one or more of certain elements such as nickel, copper, molybdenum, vanadium and others. The primary purpose in compounding these steels is to reduce the required weight of metal.

Generally speaking, high-tensile steels have little, if any, better corrosion resistance than Group 1. Since they will harden appreciably on air cooling from high temperatures, they are subject to the danger of cracking to a degree dependent on the chemical composition, the section thickness and the rate of cooling.

This class of metals is easily fabricated. Welding rods or electrodes should be used which will deposit metal having properties equal to the base material. Preheating is often required. Recommended temperatures are given in the Metals Preheating Chart, Table I.

Group 2 steels are selected where weight saving is a factor. They should not be used at temperatures above those considered safe for ordinary carbon steels.

Sub-zero Steels

As temperature is lowered below that of ordinary room temperature, the tensile strengths of most metals increase with a loss in shock resistance to a varying extent. The shock resistance of many metals falls off to an alarming degree; thus ordinary carbon steel may have an impact value of 20 foot-pounds at 65 F but may show as little as 1 foot-pound at minus 50 F. The metal selected for low-temperature service is, therefore, usually one whose impact value at the operating temperature is at least 10 foot-pounds Charpy, preferably 15 foot-pounds.

A number of suitable steels for sub-zero service are described in the chapter on "Properties of Metals at Low Temperatures" in the Handbook of The American Society for Metals. Some of these steels are plain carbon, but a great many, and especially those for very low temperatures, are of alloy composition. Naturally, the least expensive steel suitable should be selected for a given low-temperature service.

These steels may be fabricated without too much difficulty, but proper preheat and stress relief must be applied. As the alloy content is increased in the low-alloy group, the danger of cracking in welding is likewise increased. The electrodes used for these steels should be selected on the basis of acceptable physical properties and low-temperature impact resistance. For temperatures down to about minus 50 F, specially deoxidized carbon steels may be used; for lower temperatures the nickel steels, chrome-copper-nickel steels and other low-alloy compositions are suitable. For still lower temperatures, the high-chromium-nickel steels are recommended.

Carbon-Molybdenum Steels

The steels in Group 4 are similar in composition to those of Group 1 with carbon up to about 0.25%. In addition, however, they contain about ½% molybdenum, the only effect of which is to increase somewhat the high-temperature strength. Carbon-molybdenum steels are commonly used at temperatures where the strength of plain carbon steel begins to drop off appreciably, but they have no better corrosion resistance. These steels fabricate quite easily but harden somewhat more than plain carbon steels in cooling from high temperatures.

In welding carbon-molybdenum steels, preheat is generally applied in the 200 - 500 F range in order to prevent cracking. The chosen preheat temperature should increase with the carbon content of the steel, the thickness of the section and the coldness of the weather. A carbon-molybdenum electrode must be used, and stress relieving is recommended.

An investigation of piping in a steam power plant, operating continuously for several years at temperatures of about 800 F and above, has disclosed that the carbon may change from the combined state to graphite in service. It is known that the more aluminum is used in deoxidizing the steel the greater the rate of graphite formation. This phenomenon is called graphitization and results in lowered high-temperature strength and shock resistance. A method of overcoming the tendency to graphitization is being sought by adding elements such as chromium to hold the carbon in the combined state.

Chrome-Moly Steels

Group 5—½% chromium, ½% molybdenum—is a very recently developed steel that is being introduced primarily to add an element (½% Cr) to carbon-molybdenum steel to prevent graphitization. As little aluminum as possible is used in its manufacture. The composition has no better corrosion resistance than either plain carbon or carbon-molybdenum steel, nor is the high-temperature strength any greater than that of carbon-molybdenum steel without chromium. It fabricates with about the same ease as carbon-molybdenum steel.

A welding electrode depositing metal of approximately ½% chromium and ½% molybdenum should be selected. Preheat should be to about the same range or slightly higher than carbon-molybdenum steels, and stress relief should also be higher, 1,200-1,300 F.

The steels in Group 6 contain 2% chromium and either ½% or 1% molybdenum. The use of 1% molybdenum gives greater creep strength than the lower amount. The addition

of 2% chromium to plain molybdenum steel serves to: (1) increase the corrosion resistance and (2) increase further the high-temperature strength.

A considerable amount of tubing of these compositions is used in oil refineries. With power plants now being designed to operate at increasingly high temperatures, the use of Group 6 steels in that field may also be expected to increase. This type of steel can be fabricated with only slightly more stiffness than plain carbon steels, but temperatures must be controlled more closely. Group 6 steels harden considerably on air cooling from bright-red heat and therefore require careful heat treatment consisting of either annealing or of normalizing and drawing.

In welding this steel, it should be preheated to a minimum of 400 F, and postheating should be done as soon as possible after welding. Welding should be carried out with an electrode depositing metal of at least equal corrosion-resistant and high-temperature-strength properties.

Group 7. 4-6% Chromium

This group is generally similar to 2% chrome-moly except that the steels have greater corrosion resistance. They are commonly made with only ½% molybdenum. Their high-temperature strength is about the same as that of 2% Cr ½% Mo but less than 2% Cr 1% Mo.

This type of alloy fabricates similarly to the 2% Cr-Mo steel, and it also hardens severely upon air cooling. Heat treatments used are nearly the same as for the 2% Cr-Mo steels. A weld preheating temperature of 500 F is recommended, and stress relieving should be done in the 1,350-1,400 F range, followed by slow furnace cooling.

Steels of this composition should be used where 2% Cr-Mo does not have sufficient corrosion resistance.

9 and 12% Chromium

Group 8 steels, 9% chromium, 1% molybdenum, are an extension of Groups 6 and 7, differing from the latter mainly in greater corrosion resistance. The remarks made for 6 and 7 also apply to the present group except that welding should be carried out with higher preheat and using either 9% Cr-Mo or 25-20 electrodes. Stress relief should be in the 1,400-1,500 F range, followed by slow furnace cooling.

Group 9 steels, 12% chromium, are ordinarily made without molybdenum. The chief reason for using this composition is the excellent corrosion resistance, which is superior to any of the steels previously mentioned because of the high chromium content. However, Group 9 steels have no better high-temperature strength than plain carbon steel.

This composition fabricates well but hardens after air cooling from bright-red heats. It should be welded with 500 F minimum preheat and the use of 25-20 electrodes. Stress relieving should be done in the range of 1,300 to 1,400 F.

Chrome-Nickel Steels

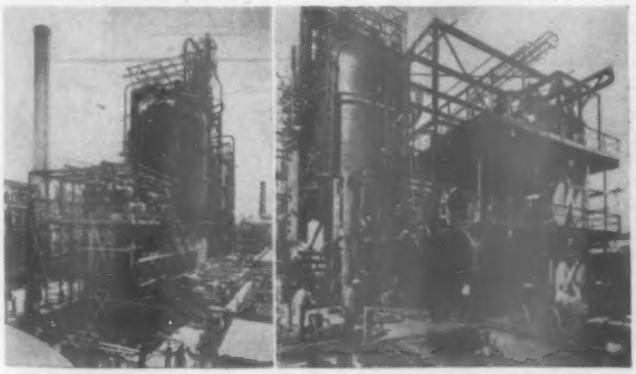
Group 10 contains the familiar 18% chromium, 8% nickel (austenitic) steel. It is one of the most expensive steels because of the high-alloy content. The austenitic steels have excellent corrosion resistance, high-temperature strength and low-temperature impact properties. They are stiff at high temperatures and therefore require more power in fabrication. The metal does not harden on cooling either slowly or rapidly from high temperature. Only cold working will cause hardening.

This steel has its best corrosion resistance when quenched from 1,800 F or above. Less corrosion resistance results when the metal is cooled slowly through the range of 1,500 to 800 F. This is due to carbide precipitation, the harmful effect of which can be overcome by the addition of columbium or titanium. The latter metals are called stabilizing elements since they tie up the carbon and allow chromium to remain in solution for best corrosion resistance. Steels of this group do not usually require preheat.

The Metals Preheating Chart, Table I, gives recommended preheat temperatures for all of the steels discussed as well as for a great number of other compositions. It also gives general rules governing the need for preheating. Thermometric crayons furnish a simple and accurate means of determining the desired temperatures in preheating, stress-relieving, etc.

The selection of the proper steel for a particular piping application is an important factor. Naturally the cheapest steel suitable should be chosen for any particular operating condition. This means usually that the lowest alloy steel should be considered.

The lower the carbon content in any of these compositions, the less difficulty will be encountered in fabrication. The higher the carbon content, the greater the danger of cracking, the more difficult the heat treatment and the less the corrosion resistance.



Courtesy, The Lincoln Electric Co.

This 33-ft diameter vacuum fractionating tower was constructed by use of arc welding at a saving of $36,860

Courtesy, The Hobart Brothers Co.

This welded high-pressure header carries 300 psi and is constructed of ⅝-in.-wall pipe, 14 in. in diameter

★ MAINTENANCE

A 6-ft. Braze in Cast Iron

BY H. W. YOUNG

With the help of a supersize preheating torch, Weiss Welding Works successfully completed a difficult job of repairing broken cast-iron bases.

THE MAJORITY of custom welding shops would probably balk at the brazing job shown in the accompanying picture. That the Weiss Welding Works, San Francisco, tackled it at all and then did it successfully was mainly because this concern possessed a supersize preheating torch.

Breaks Were 6 Ft Long

The job consisted of two cast-iron bases for mill rolls. The vertical web plate of each piece had been broken in two in shipment. These webs were approximately 1 in. thick, and the breaks were each 6 ft long.

To have attempted to weld such a break with cast-iron rods would have necessitated bringing the whole piece to a cherry red and then welding under fire—a ticklish job to do at best, added to which would have been the strong probability of warping. So it was decided to make the repairs by brazing.

The broken pieces of each web were first prepared by beveling them with a chipping gun, leaving thin edges all the way around to permit the pieces to be properly aligned. The pieces were aligned vertically, one above the other, and then tacked together with brazing metal.

Next the whole piece was preheated to a dull red by means of the large torch, to be described later. The heated piece was then laid down on its side, and three men went to work on it simultaneously, taking equal sections. By brazing three sections simultaneously, the stresses were equalized and distortion avoided. The braze was made in two passes; the first pass filled the bottom of the groove with the bronze metal, and the second completed the braze on that side. The piece was then turned over, and the brazing was completed on the other side without reheating.

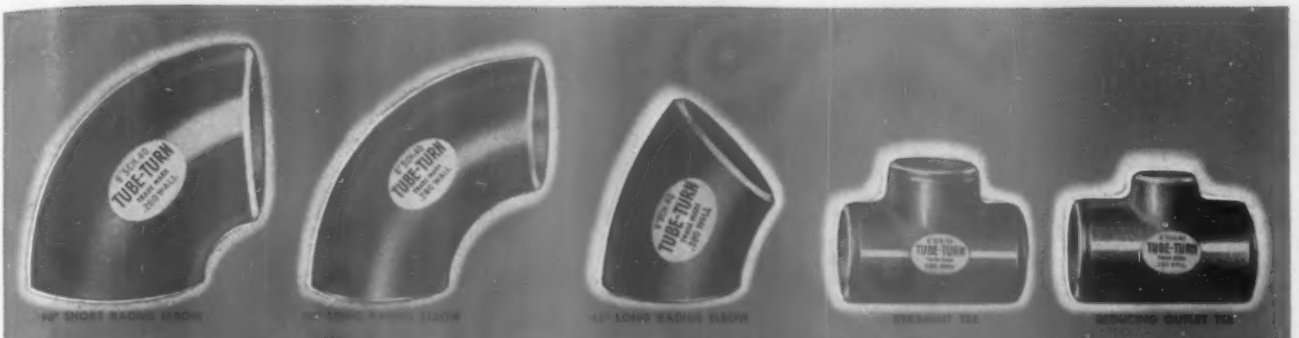
Stress Relieve with Torch

When the brazing had been completed, the piece was again set up vertically and heated with the torch to a cherry red. It was then allowed to cool naturally. No warping took place in either piece. The final step was to grind off the excess metal and polish the work to a smooth finish.

Casualties: One Pants Seat

As said before, the accomplishment of this piece of work depended primarily on the preheating torch employed. This consisted of an air-oil burner of the largest size. The fuel, Diesel oil, is forced through the line under air pressure, a compressor unit of considerable size being used. This torch is able to shoot a blue flame four feet long. The yellow part of the flame will go very much farther and have enough preheating effect to practically ruin a pair of britches at fifteen or twenty feet, as one employee found by incautiously backing into it.

Admiring their unusual job of brazing cast-iron bases for mill rolls are William Weiss, Jr., Victor Copp, Dale Walker and William A. Weiss, of the Weiss Welding. Brazes were each 6 ft long by 1 in. thick. Note the big torch for preheating



TUBE-TURN

TRADE MARK

WELDING FITTINGS AND FLANGES

TUBE-TURN WELDING FITTINGS—RANGE OF SIZES

Type of Fitting	Description	Standard Weight	Extra Strong	Schedule 160	Double Extra Strong	Light Gauge	
						Nominal Pipe Size	Iron Pipe Size
Elbows	90° Long Radius	½"-24"	½"-24"	1"-12"	¾"-8"	4"-24"	3"-12"
Elbows	90° Short Radius	1"-30"	1½"-30"				
Elbows	45° Long Radius	½"-30"*	½"-30"*	1"-12"	¾"-8"	4"-24"	3"-12"
Returns	180° Long Radius	½"-24"	½"-24"	1"-12"	3"-8"	4"-24"	3"-12"
Returns	180° Short Radius	1"-30"	1½"-30"				
Returns	180° Extra Long Radius	1"-2½"	1"-2½"				
Tees	Straight	½"-24"	½"-24"	½"-12"	½"-8"		
Tees	Reducing Outlet	½"-24"	½"-24"	½"-12"	½"-8"		
Reducers	Concentric & Eccentric	1x½-24x20	1x½-24x20		1x½-8"x6"		
Caps		1"-24"	1"-24"		1"-8"		
Stub Ends	Lap Joint	1"-24"	1"-24"				
Nipples	Shaped, 90° to Header	1¼"-12"	1¼"-12"				
Nipples	Shaped, 45° to Header	1¼"-12"	1¼"-12"				
Saddles		2"-24"**					
Laterals	Straight	1¼"-24"	1¼"-24"				
Laterals	Reducing-on-Run	1¼"-24"	1¼"-24"				
Crosses	Straight	¾"-24"	¾"-24"				
Rings	Welding	¾"-12"	¾"-12"				
Sleeves	Welding	2"-24"**					

SUPER Tube-Turn 45° long radius elbows, 90° long radius elbows, and 180° long radius returns available in both Standard weight and Extra Strong in sizes from 3" to 12".

Tube-Turn welding fittings and flanges conform to applicable ASA and ASTM Standards. For further details please refer to Tube Turns catalog and data book No. 111.

*30" size short radius

**Since saddles and sleeves are used for external reinforcement only, they do not conform to iron pipe size thicknesses.

TUBE-TURN FORGED STEEL FLANGES—RANGE OF SIZES

	150 Lb.	300 Lb.	400 Lb.	600 Lb.	900 Lb.	1500 Lb.	2500 Lb.
Welding Neck	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Slip-on	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Lap Joint	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Threaded	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Blind	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Socket Type	¼"-24"	¼"- 4"		¼"-3½"			
Reducing-threaded or slip-on	¾"-24"	¾"-24"	¾"-24"†	½"-24"	½"-24"*	¾"-24"	¾"-12"
Orifice—threaded		1"-24"	4"-12"	4"-12"	3"-12"	1"-12"	
Orifice—slip-on		1"-24"					
Orifice—welding neck		1"-24"	4"-12"	1"-12"	3"-12"	1"-12"	
Long Welding Neck	1"-24"	1"-24"	1"-24"	1"-24"	1"-24"	1"-24"	1"-12"

†Dimensions on sizes thru 3½" same as for 600 lb. flanges.

*Dimensions on sizes thru 2½" same as for 1500 lb. flanges.

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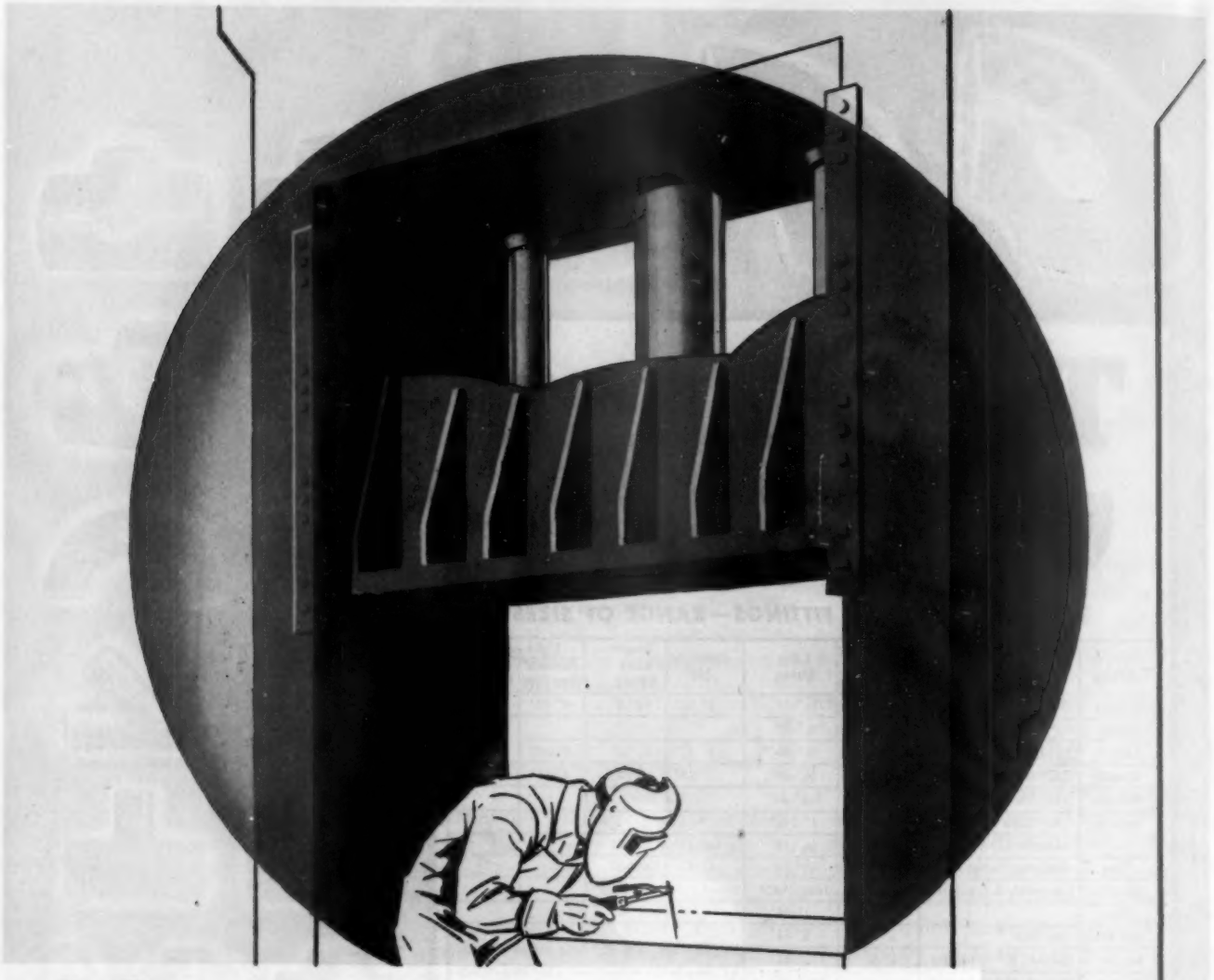

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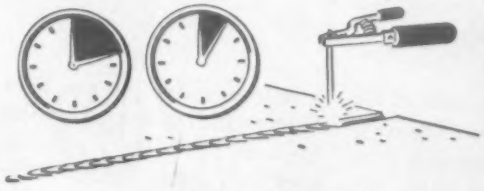

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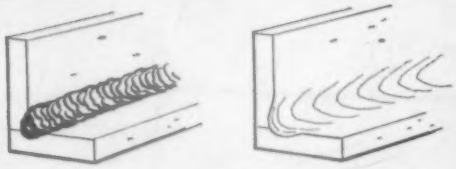

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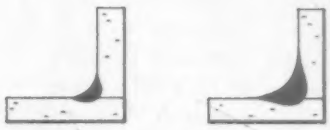
Weld metal "feathers out" — neat and uniform. It eliminates notched effect along weld edge — improves product appearance.



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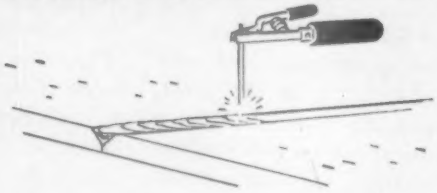

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AWS E-6013	AWS E-6012	AWS E-7011	AWS E-6020	AWS E-6013	AWS E-6012	AWS E-6011	AWS E-6010

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★ CONSTRUCTION

Welding Sequence at Sv

★ Part Two—Mr. Baysinger tells why and how the end-to-middle sequence was developed to build T2-SE-A1 turbo-electric tankers.

In the May issue of THE WELDING ENGINEER, *the author explained why the welding bottleneck at the Swan Island shipyard, Portland, Ore., rendered imperative the development of the new end-to-middle sequence which erected a hull in three parts. The present and final installment gives procedure details and tells the methods that were used to minimize shrinkage stresses.*

—THE EDITORS

SINCE the forward and aft ends of the hull presented the most difficulty, it was decided to try scheduling construction in three separate units: aft of the cofferdams at frames 46-47, the cargo tanks and forward of bulkhead 71. These separate units were to progress simultaneously and be welded together as the hull neared completion. This "end-to-middle" sequence, a name applied to distinguish it from the open-end sequence, would permit the machinery and pipe installations to begin when the hull reached approximately 30% of erection instead of 80% as had formerly been the case. The proposed method, however, represented a radical departure from accepted shipbuilding procedure.

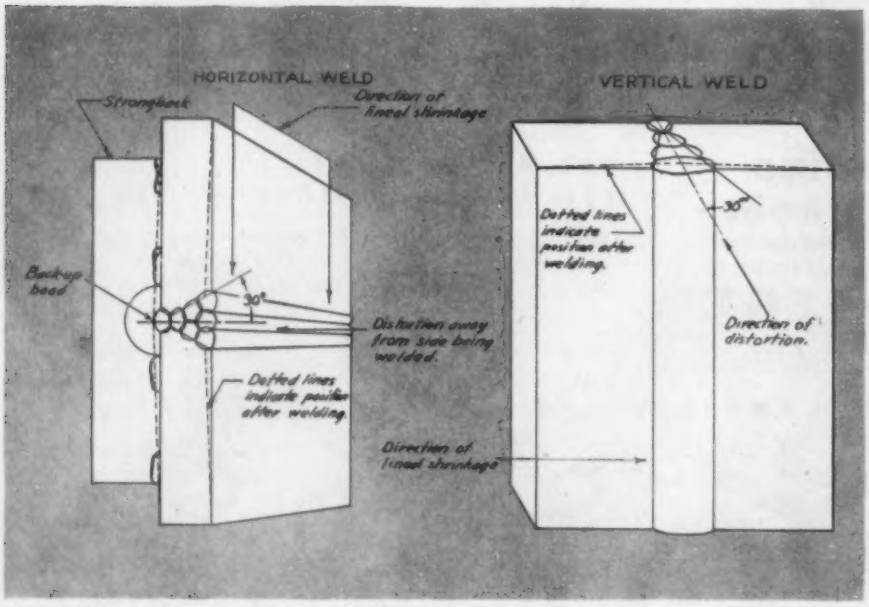
LIST WELDING ON CARDS

All welding on the hull structure was detailed and listed as individual jobs. The amount of welding listed as a representative job was limited either to an estimated normal amount of welding capable of accomplishment by a crew in a single shift or to the welding required for installation of a single item of machinery. These jobs were set up on cards (Fig. 4), which gave an adequate description of the work involved and the footage of weld. Appropriate spaces were provided to record assignment of the job and its completion. These cards could be readily arranged in an issuance order to produce any desired welding sequence. The major welds in each sequence were "followed through" by marking them in on shell expansions, drawings and diagrams of the hull to insure that they fulfilled the requirements of accepted welding procedure.

Fundamental rules followed in planning the welding sequence were to: (1) reduce the restraint against weld shrinkage to a minimum; (2) avoid conditions which would be likely to result in an accumulation of weld defects at points of unavoidable lineal or multiaxial stress; (3) plan sequences to avoid distortion without creating excessive restraint against weld shrinkage in the direction of greatest shrinkage; and (4) stress relieve closure butts in cases where longitudinal lineal shrinkage might be sufficient to cause fracture.

Studies of many failures in shell plating, made by the American Bureau of Shipping and the United States Navy separately, revealed the same fact: in cases of failure, several strakes had been faired and tacked in advance of welding, and welding had been carried on simultaneously on several strakes, even though pyramid sequence had beeen strictly followed in welding loose plate. The lineal vertical shrinkage in the horizontal welds either broke the

Fig. 6—Distortion and lineal shrinkage caused by welding is greater in horizontal than in vertical welds, experience shows



* The author wishes to express appreciation to Albert Bauer, assistant general manager, Kaiser Co., Inc., Portland, Ore., for the material used in this article.

Swan Island

BY FRANK ROBERT BAYSINGER*

tacks in the upper plates and caused widening at the seams or caused undue residual stress in tack increments that had not broken. On the basis of these facts, the recommended sequence for welding loose shell plate was to weld the vertical butt first, then the lower horizontal seam, the next vertical butt, the next horizontal seam and so on through the first strake as shown in Fig. 5. The second vertical butt was not to be faired until the first vertical butt weld had been completed, nor was the lower strake to be faired to the upper strake until the lower horizontal weld was completed. Thus stress caused by lineal shrinkage was kept at a minimum because one end or edge of the plate was always free to move.

Strongbacks Reduce Distortion

Distortion in plates toward the side opposite that being welded is shown by experience to be greater in horizontal than in vertical welds. This distortion in horizontal welds was reduced by the use of strongbacks tacked across the butt at right angles. Edge preparation was made on the outside of the shell so that these strongbacks and consequential tacks that might mar the "skin" were used inside the shell. The distortion and lineal shrinkage caused by both horizontal and vertical welds is shown in Fig. 6.

The new end-to-middle sequence was planned with strict application of the above experience. The forward unit of the hull offered little difficulty as the welds progressed in a forward direction (as in former procedure) with a closure to the bow section. The middle unit of cargo tank sections pyramided from midships as before. In the aft section, however, it was found necessary to gain additional time by reversing the direction of welding above the horizontal seam of "D" to "F" strakes. (See Fig. 3 in Part One.)

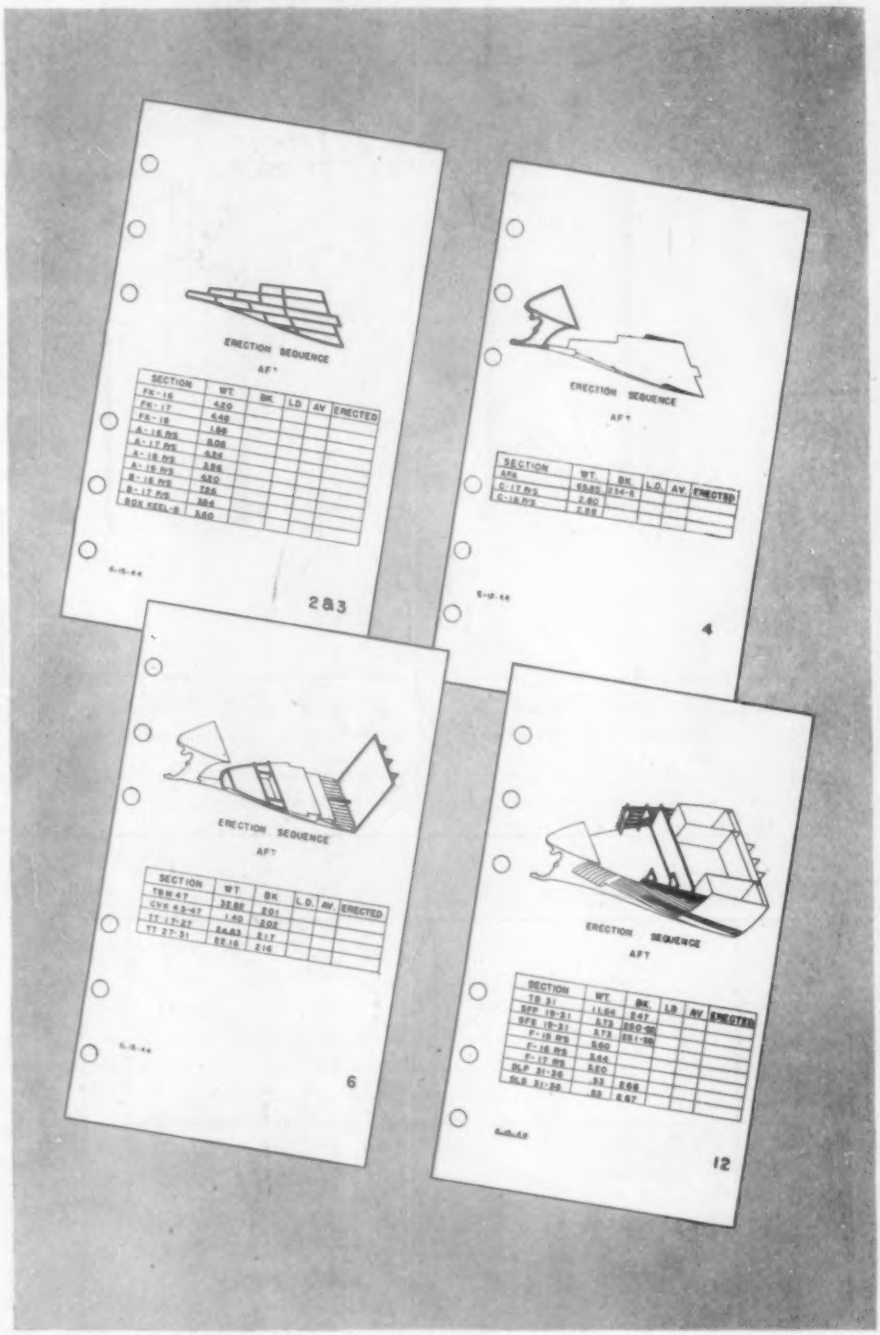


Fig. 4—Sequence cards were used to detail all of the welding on the hull structure. These cards could be arranged to produce any desired sequence

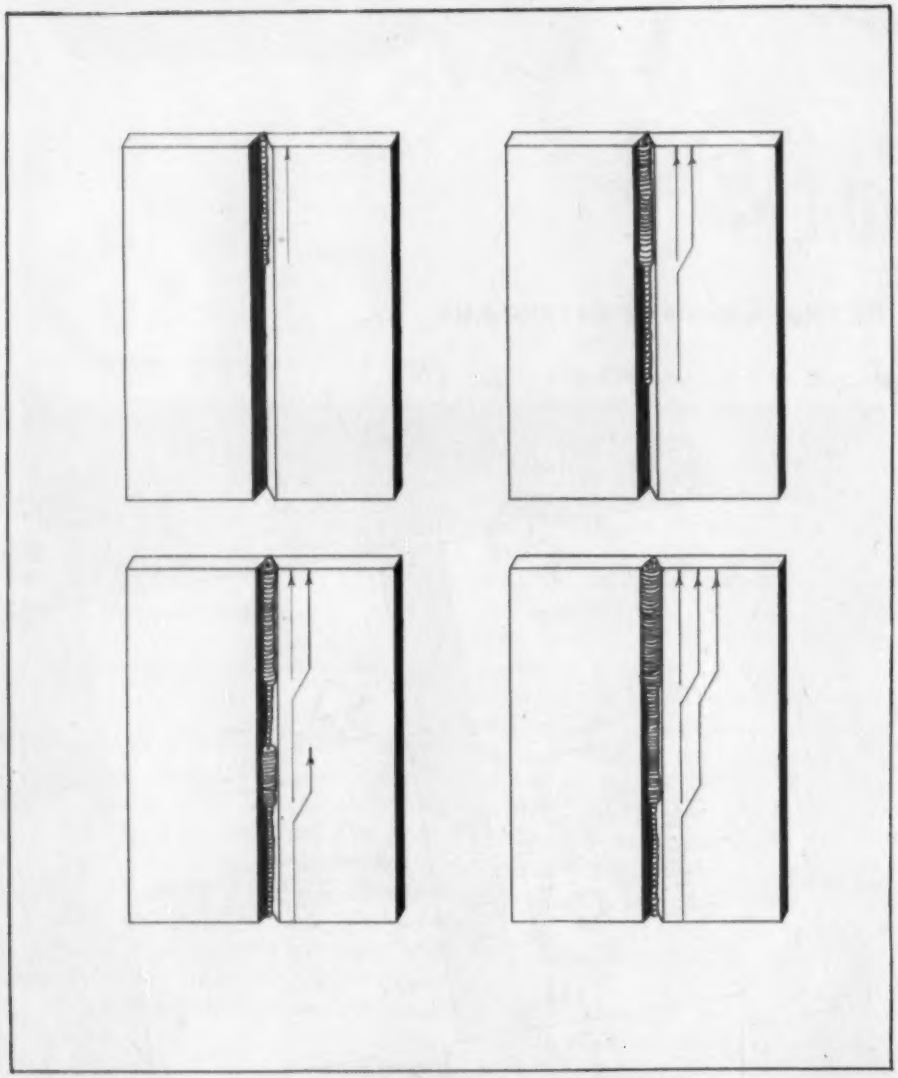
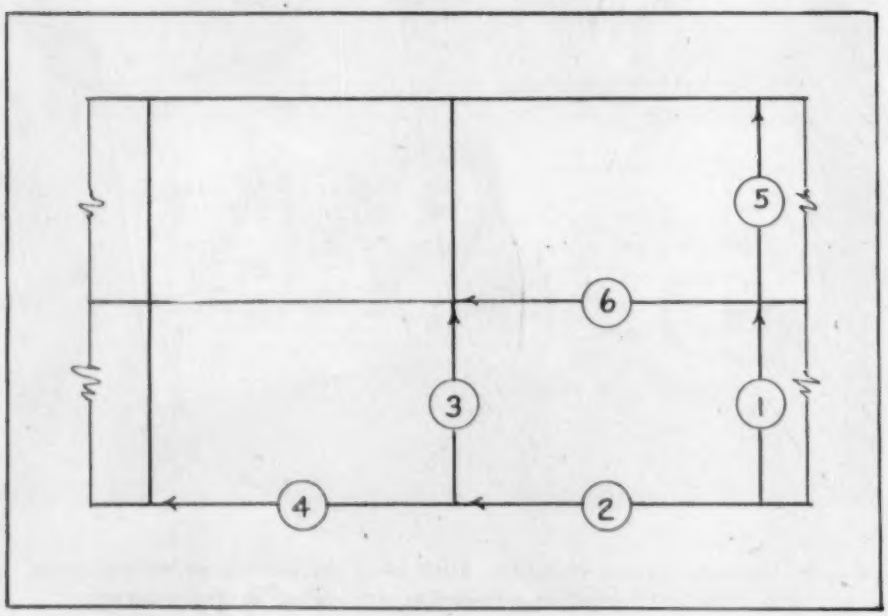


Fig. 8—Order of deposition used in welding vertical closure butts. The overlapped passes avoid craters and poor fusion at stopping points

Fig. 5—Approved welding sequence for welding loose plate. The numbers in the small circles indicate the order of welding



This meant welding from forward to aft all shell plate and double bottoms to and above the tank top and then reversing the direction of welding and progressing from aft forward on all shell and framing up to and including the upper deck. In this manner the after peak was given final location at an early stage, and critical areas such as the stern tube and shaft alley could be scheduled more favorably.

The remaining problems were to establish the order of deposition of the weld metal in the closure butts in order to minimize defects that might be caused by thermal cracking in the root pass, slag inclusions and oxidized craters at points of withdrawal of electrode from the molten puddle; and to determine the best means of stress relieving the closure welds.

Concerning the first problem, all closure butt welds of the deck were to be block welded and peened, and the ends of the deposited beads were to be cascaded as shown in Fig. 7. Electrodes of AWS classes E-6012 and E-6030 were specified.

Vertical Welds Overlapped

AWS E-6010 electrodes were specified for welding the vertical closure butts, and the following order of deposition was developed:

The first increment of the root pass was deposited, starting about 10 in. from the top and welding up to the top. The second root increment was started 20 in. from the top, the weld progressing up to the first increment and right up over it without breaking the arc. The third increment was started 30 in. from the top, the weld progressing up to and over the second increment and on up over the first two as shown in Fig. 8. This method of lapping the passes avoids the double defect caused by stopping a weld increment and leaving a crater at the point of poor fusion where another increment is started.

Residual stresses in vertical closure butts were minimized by block welding with skips between, by preheating in cold weather and by chipping out tack increments as the welding progressed. Stress relieving by flame-heating was ruled out as impracticable, and it was decided that it would be sufficient to peen each weld increment immediately upon deposition. In actual practice, it was found that these closures required a special amount of care in flame-cut-

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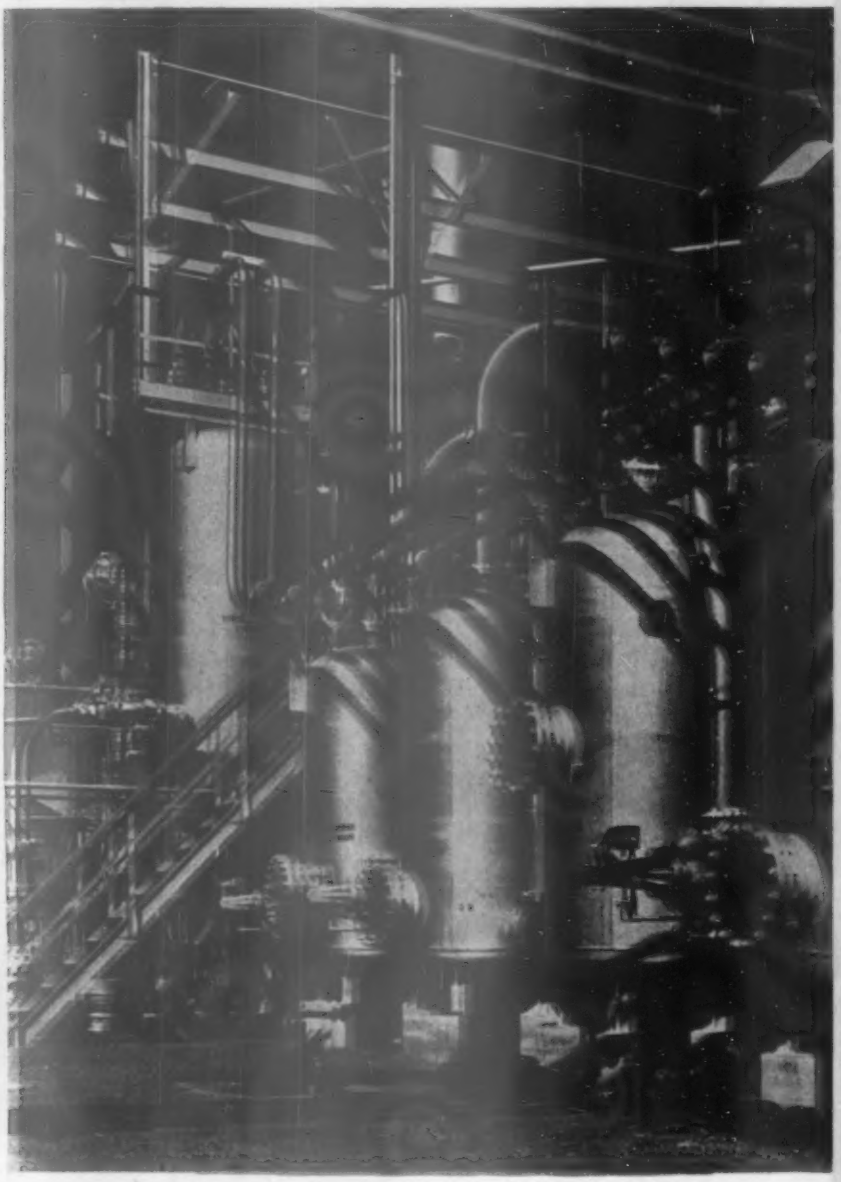
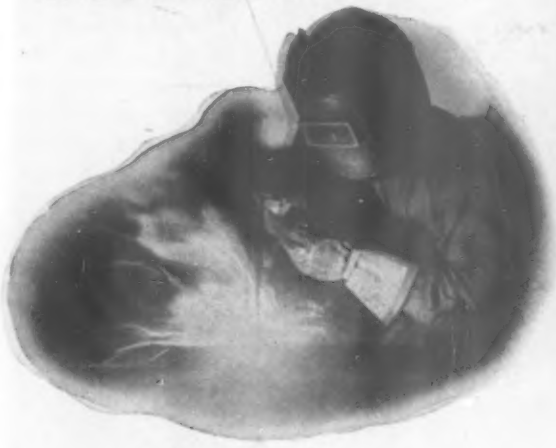


They can help your welding shop get more business



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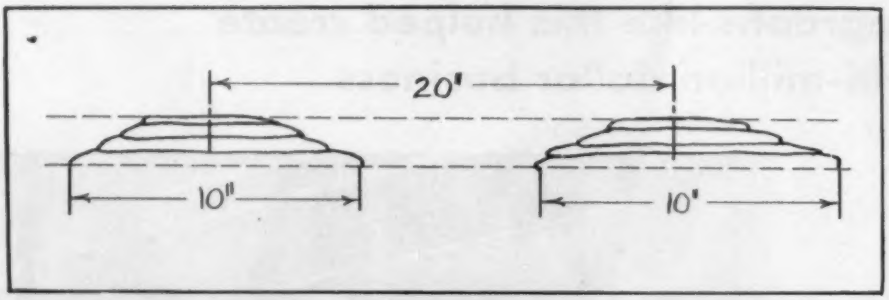


Fig. 7—Cascaded block and skip order of deposition for main deck closures. All closure butt welds of the deck were block welded and peened

ting for edge preparation in order to avoid notch effects in areas where the structural strength of the hull was concerned.

The method developed was such as to fully satisfy the requirements of the American Bureau of Shipping, and approval by that agency was given by David Arnott, vice-president and chief surveyor.

All Departments Coördinated

Following approval of the end-to-middle method of construction, a unified schedule was evolved to coördinate production of all departments. Based upon the order of the job for welding, for example, a corresponding breakdown was applied to the jobs of shipfitting, and these jobs were scheduled so that welding could be kept available in the proper order. The resulting order of shipfitting jobs was used to set up the sequence for sections to be completed by the assembly departments, which in turn governed the order in which steel was fabricated in the plate shop. The unified schedule allowed machinists, pipe fitters and other crafts a much more efficient spread of their crews and permitted arrangements to develop maximum efficiency.

To facilitate control of welding and shipfitting, a chart was devised covering the entire construction period of the ship. In vertical columns, welding jobs for the entire hull were listed by location such as boiler room, shaft alley, feed water tanks, etc. In horizontal columns, the days from keel laying to delivery were listed to show each day's welding jobs, which were in turn keyed to fitting jobs. These were scheduled according to proper welding sequence for all major hull welds and according to the requirements of other crafts for machinery foundations, hangers, brackets, etc. Welding in all tanks requiring hydrostatic testing was scheduled to finish in the order in which it was desired that testing be accomplished.

These columns were colored as jobs were fitted for welding and then colored a darker color as welding was completed. A continuous visual check of the status of fitting and welding was thus afforded. If for any reason a job failed to be completed in its normal order, it was immediately apparent as being out of sequence.

Allocating Daily Jobs

The number of welding jobs allocated to any specific day of work on the chart was governed by comparison of the sum of the welding footage represented by the day's cards to the welding footage desired, as shown by ideal welding curves. The construction period shown on the chart and erection diagrams was composed of thirty work days. This period, however, could be readily expanded or collapsed to fit any desired interval.

By keying other production crafts to the welding and fitting charts, all of the work was gradually coördinated into a single overall schedule. This made possible a fixed order of work, and, as jobs became more repetitive, production reports indicated a steady improvement in reduction of construction time and cost.

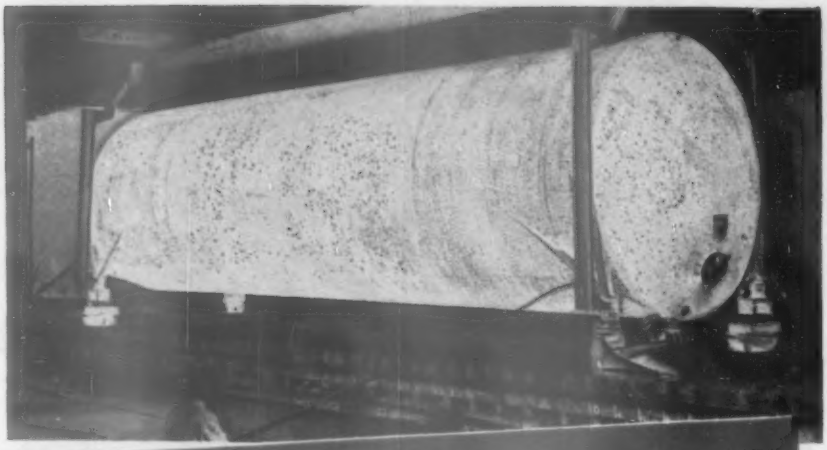
The prime worry of the engineers who developed the end-to-middle sequence was whether or not severe stresses might be developed in the ship's hull because of the closure welds. However, there were no fractures in the ship structure traceable to stresses resulting from the revised welding sequence. Furthermore, hog and sag tests continued to indicate full flexibility approximately equal to riveted construction. The sequence therefore accomplished its intended purpose in time and cost reduction without sacrificing structural strength of the ships.

☆ ☆ ☆

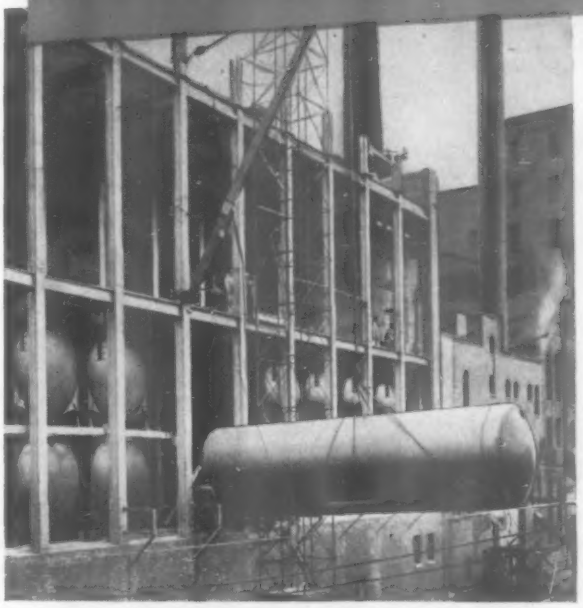
Rivetless Caboose

The changeover from riveted to welded construction is becoming commonplace among railroad equipment manufacturers. The all-steel welded caboose pictured at the right, shown through the courtesy of The Lincoln Electric Railway Sales Co., Cleveland, is one of dozens in service with the Great Northern Railway Co. It was built of mild-steel sheets fused into an integral unit with 5/32-in., general-purpose electrodes.

1933 Thousands of man-hours of welding research went into development of a SMITHway Electrode over the weld of which glass coatings could successfully be applied. The result was production of this first large single-piece glass-lined tank, shown emerging white hot from the gigantic furnace.



Out of Welding Research... BETTER BEER



1946 Since the first SMITHway Glass-Lined Storage Tank was built in 1933, hundreds of brewers throughout the world have equipped their lagering cellars with SMITHway glass-lined tanks . . . a combined storage capacity of 39,486,188 gallons.

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On the Job

Carbon-Arc Lead Welding

LEAD WELDING (sometimes inaccurately referred to as "lead burning") is usually done with a gas torch and filler rod, and is an extremely difficult task to accomplish. A better way—the use of the carbon arc—was found at the Hobart Trade School, Troy, O.

The occasion arose in the preparation of a lead-lined room to house a 250,000-volt X-ray inspection machine. Lead sheets ⅛-in. in thickness were required to confine the penetrating rays within the X-ray room. The walls were easy to cover: the lead sheets were merely lapped and nailed into place. The floor, however, could not be treated in this simple manner, for the lapping would result in a series of ridges which would eventually wear through. Furthermore, a smooth, even surface was necessary to provide a foundation for the asphalt tile blocks to be laid over the lead. Hence it was absolutely essential to find an efficient method of butt welding the sheets.

The gas torch was deemed too slow for this big job, and a carbon-arc torch was substituted, using strips cut from the lead sheets for filler rods. A standard 300-amp arc welder was used with an attachment that reduced the current to the low setting of 15 amp at 15 volts.

In welding lead, the work must always be in the downhand position and well backed up with steel or copper. These two conditions were met automatically by the fact that the lead was being laid on a steel floor which provided a perfect backing. The joints were welded at the rate of 24 to 30 in. per minute by puddling the melted filler strips with a slight weaving motion. The finished bead had a good appearance and joined the sheets perfectly (see accompanying picture).

☆ ☆

Cast-Iron Compressor Repair

A LARGE air compressor had been quietly chugging along for 25 years in a midwestern coke plant when it suddenly decided to quit. The trouble shooter found that there were two cracks in the cast-iron base. One of them was 14 in. long, and the second and more formidable crack measured 3½ ft long. Both were in the section over the crankcase where the iron is ¾ in. thick. Both, of course, were saturated with oil.

The best time estimate that the master mechanic would make for dismantling, repairing the base by brazing and reassembling the compressor was about three weeks. This seemed a prohibitively long time to have the compressor shut down, thought the coke plant manager.

To expedite the job, it was decided to try metal-arc welding with a special nickel electrode for cast-iron welding developed by the International Nickel Co., Inc. The cracked areas were prepared, and the base was welded in place by a skip-welding technique. The compressor was back in operation in two days. A check-up made eight months later describes the repairs as "sound, neat and permanent."

The operator shoots a jet of hydrogen onto the work from the hose in her right hand

Hydrogen Spot Welding

THE USE of hydrogen in arc welding is well known, but its application to spot welding is something new. Such a process has been developed at the Brooklyn plant of the Amperex Electronic Corp. to spot weld the parts of an 857 rectifier tube. A small rubber hose, held in the operator's hand, shoots a jet of hydrogen onto the work to prevent the formation of oxides and the absorption of oxygen in the heated metal.

Very heavy tungsten leads are necessary in the tube in order to carry the 40-amp filament current.

Photos courtesy The Hobart Brothers Co.

The finished bead has a good appearance and joins the lead sheets perfectly

Joining the lead floor to the walls with the carbon arc. Note the lead strip used for a filler rod

Rectangular .20 carbon steel bars were veed, then welded with TITAN MANGANESE BRONZE. After machining, the bars were bent in a tensile machine. The strong bond, ductility, and toughness of the welds are evident.

Titan Manganese Bronze Welding Rods

OUTSTANDING FOR ABRASION-RESISTING APPLICATIONS

The TITAN MANGANESE BRONZE WELDING ROD is a low fuming bronze welding rod with manganese added for greater hardness and toughness. Welds made with these rods possess high resistance to abrasion and therefore are widely used where a hard bearing surface is necessary; for example, on valves, pistons, seal rings, and shafts.

Minimum Preheating Required: In locomotive and automobile repairing and in shipbuilding, repairs must often be made on cast iron pistons, gear teeth, and stripped threads while the particular casting is in place. Since TITAN MANGANESE BRONZE WELDING RODS melt at a low temperature and possess excellent tinning properties, a minimum of preheating is necessary . . . enabling welds to be quickly executed on these applications.

Applicable on Surfaces which Cannot be Cleaned: The TITAN MANGANESE BRONZE WELDING ROD has been developed and alloyed in such a manner as to permit flowing in an even layer over cast iron containing grease and rust which cannot always be removed prior to welding. Furthermore, its ease of application permits relatively inexperienced operators to make sound joints in intricate castings.

Unequalled for its application on cast iron and steel, TITAN MANGANESE BRONZE has also proved highly successful when used on malleable, wrought, and white cast iron, and on galvanized materials.

MADE BY

TITAN METAL MANUFACTURING CO.

BELLEFONTE, PENNA.

Aluminum-Bronze Overlay

By Paul Montanye

RAILROAD maintenance superintendents have investigated and are now testing the uses of aluminum-bronze electrodes, particularly the harder grades, for bearing metal. The shopping cycle on some parts of locomotive equipment can be lengthened up to 300% by overlaying them with aluminum-bronze weld deposits.

A typical test application is the lateral face on a journal driving box assembly for a locomotive on a southern railroad (see picture). This face was to be overlaid with aluminum-bronze weld metal to replace a softer bronze. The shop superintendent selected an all-purpose coated aluminum-bronze electrode having an as-deposited hardness of 119 to 121 Brinell (AWS-ASTM specification E Cu A1-A). This electrode was chosen because it provided the desired range of Brinell hardness for mating bronze to steel.

After grease and dirt had been removed from the lateral face, the casting was submerged in a tank of cooling water; this practice prevents warpage and permits the operator to hold interpass temperatures to a minimum. Because of the cooling method, it was not considered necessary to remove the half bearing inside the assembly. However, it was thought advisable to build a dam around the inner and outer edges to prevent the molten weld metal from spilling. The dam made it possible to use a large-diameter electrode (⅜ in.).

This test application has given excellent wear results. The actual maintenance and down time have been reduced by 50% or more.

Courtesy Ampco Metal, Inc.

Overlaying the lateral face of a locomotive journal driving box with aluminum bronze

☆ ☆

Valve Extensions

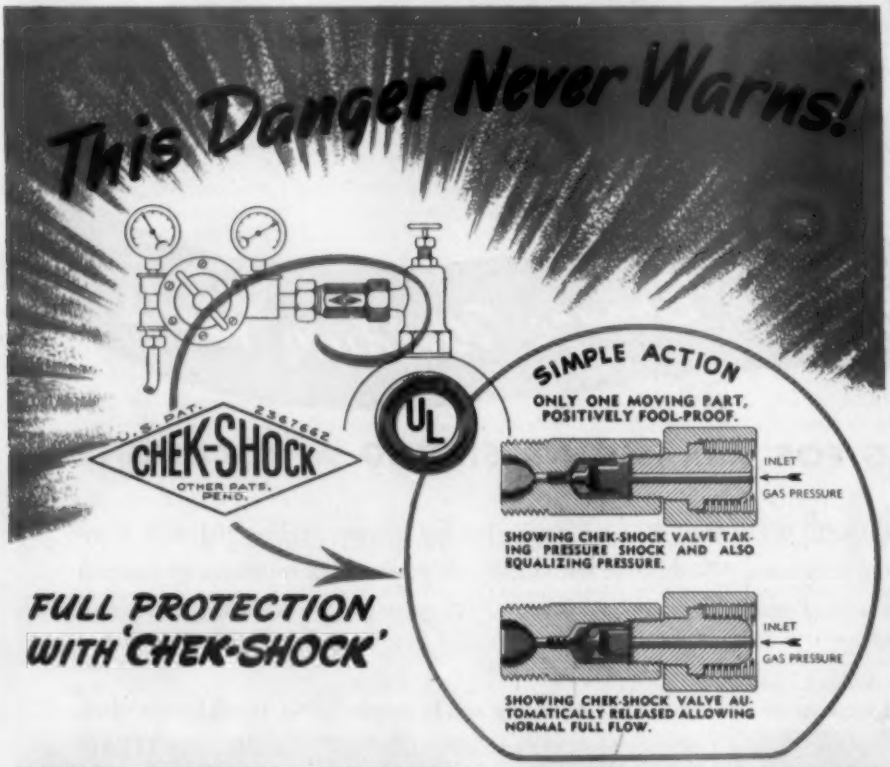
By Elton Sterrett

THE STEMS of valves controlling the flow of water to a treating unit extended some 6 in. above the steel mesh flooring—an awkward height for the operator to handle. The plant weldor was called in to bring the valve wheels to the hand height of a man standing.

He did this by fitting extension rods of the forked or yoke type to discs engaging the squares at the tops of the four valve stems. The rods were carried through a bearing plate welded to the supports of the treating unit.

To protect the valve bodies and stuffing boxes from possible damage, the weldor also formed a curved toe plate of ¼-in. steel plate and welded it around the bases of the stems as shown in the picture. The short ends of the flooring were tack welded to this plate to stiffen the construction. Ample space was left within the curve of the guard to enable a wrench to be used to tighten packing in the glands.

Welded extension rods through a welded bearing plate brought these four valve wheels to a height convenient for a standing operator



CHEK-SHOCK OXYGEN CUSHION VALVE

SOFTLY controls the vicious "jolt" of high pressure oxygen gas, thus eliminating regulator repairs and preventing possible injury to operators.

- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will increase life of regulator assembly.
- Will eliminate possible injury to operator from burstings.
- Will prevent unnecessary internal wear in regulator *(as NOT necessary to release control screw before opening tank valve).*

This PROVEN automatic safety device cushions the initial "blast" of pressure when tank valve is turned on. (this uncontrolled surge which strikes like a hammer is the direct cause of most damaged regulators and accidents), when pressure slowly bleeds and equalizes then CHEK-SHOCK allows a full flow of oxygen.

PRICE IS LESS THAN ONE REPAIR BILL

\# 1. STANDARD COUPLER—for all standard size welding type oxygen regulators.
\# 2. LIGHT COUPLER—for "airplane" or soldering size oxygen regulators.
\# 3. HEAVY DUTY COUPLER—recommended for extra heavy duty work only. **$6.00 ea.**
\# 4. SCREW TYPE COUPLER—for removable inlet stem regulators (¼" pipe) available in standard, light, or heavy capacities.
\# 5. FOR HYDROGEN—left hand thread coupler. We also make Medical Chek-Shocks for all types of medical regulators and tank fittings (chrome plated).....$7.00 each

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STAR PERFORMANCE

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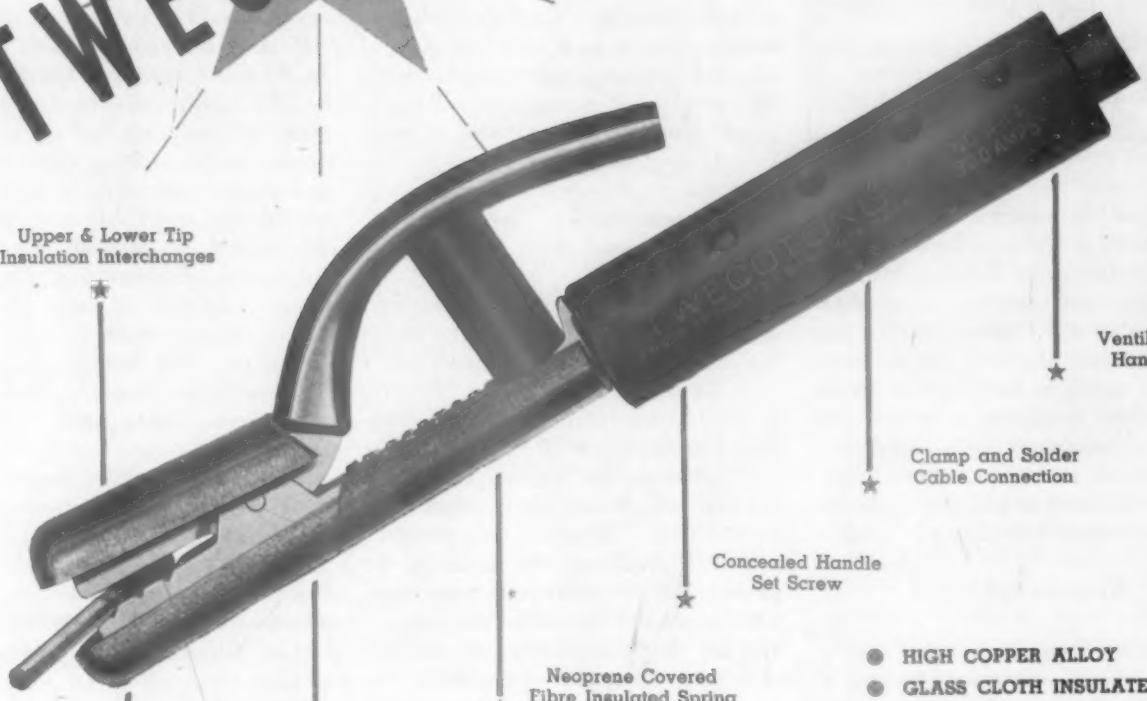
300 Amps.—¼" Rod	500 Amps.—⅜" Rod
$5.00	$8.00

Less in Quantity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Ventilated Handle
Clamp and Solder Cable Connection
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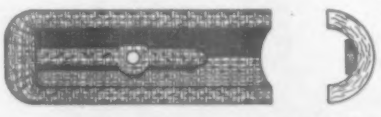
Neoprene Covered Fibre Insulated Spring
Insulation Screws Deeply Countersunk
Tubular Internally "Keyed" Insulation

- HIGH COPPER ALLOY
- GLASS CLOTH INSULATED
- ALL PARTS REPLACEABLE
- SAFETY ENGINEERED



TWECOTONG insulation is exclusive in design and material. "Tubular-Keyed" construction with deep-set boss snugly locates each piece on the holder casting. Glass Cloth (laminated) Bakelite insulators withstand great impact, heat and arc burn. This combination assures maximum holder service with a minimum of maintenance. TWECOTONG is covered by Patent Pending.

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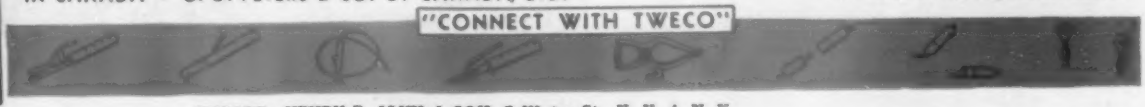

EXPORT: HENRY R. JAHN & SON, 7 Water St., N. Y. 4, N. Y.

★ RESEARCH

Constitution of Weld Metal*

BY W. ANDREWS

A British metallurgist discusses the effects of gases and non-metallic inclusions upon the weld metal.

DETAILS of research work carried out while I was on the staff of the Advisory Service on Welding, Ministry of Supply, are contained in a paper presented to the Institute of Welding and published in their *Transactions*. It seems useful, at this stage, to review the evidence available as to the condition of mild-steel weld metal and the reactions in which it may participate in conjunction with the mild-steel plate with which it is normally used.

Effects of Gases

Mild-steel metal may contain relatively large volumes of hydrogen, which, in the cases of the multiple deposits examined, was found to be in linear proportion to the potential hydrogen in the flux coating, although the amount retained in these welds was a very small proportion of the volume actually available. Hydrogen is known to have an embrittling action on steel.

The total oxygen content of a steel has been shown to be a measure of the quantity of the non-metallic inclusions present. In the case of low-carbon steel weld metal, the identity of the vacuum fusion value for the total oxygen and the figure found after the iodine extraction residues have been evaluated is so good that it is obviously a direct measure of the cleanliness of the metal. This is shown in the mild-steel weld metal examined to be much inferior to that of mild steel processed by other methods. It is possible, therefore, that part of the spontaneous cracking of weld metal is explained by the coincidence of a very high hydrogen content during the early stages of solidification and a high non-metallic inclusion content. The latter, much of which must be in a very fine state of division almost impossible to detect by present-day microscopic technique, would tend to be distributed to some extent in the boundaries of the columnar crystals which form normal to the weld surface. It would thus weaken the metal along the principal stress axis.

Non-metallic inclusions might well serve as nuclear spaces for the building up, by diffusion, of minute pockets of molecular hydrogen under pressure, a mechanism parallel to that suggested as the cause of "hairline cracking" in alloy-steel ingots. There are, of course, several other factors involved which influence this phenomenon of cracking—the build-up of stress in the particular joint concerned, the character of the parent plate, etc.—and no single hypothesis can be expected to explain completely so complicated a matter. One might think, for example, that the operation of metal-arc welding under water would be liable to severe weld cracking, but this does not occur as often as might be expected. In this case it may be that the metal cools so rapidly that the rate of increase of strength outstrips the speed at which the joint stress builds up to a maximum.

Whatever the full explanation, much light is thrown on the differences between different types of electrode fluxes by the accumulation of data on the hydrogen and oxygen contents of the metal along the lines already explored. It also seems clear that electrodes of low potential hydrogen content, giving weld metal of low non-metallic inclusion content, are likely to be most resistant in the long run.

Most Common Impurities

The details of the effects of the different kinds of non-metallic inclusion on the quality of the weld metal have not been sufficiently widely explored to date, but reference has been made to the very abnormal carburized structure obtained with weld metal from electrodes having fluxes with high iron-oxide contents. As this test is within the scope of most industrial laboratories, it is possible that a useful means of classifying the various types of weld metal could be devised. Apart from the iron-oxide bearing fluxes, the most common impurity in weld metal seems to be rhodonite, a manganese metasilicate, containing either a little iron oxide or excess silica to replace part of the manganese. It is usually partly vitreous due to rapid cooling, and much of it is apparently in a very fine state of division. Rhodonite is the predominant non-metallic inclusion in the rutile, fluoride and anhydrous fluxes, the latter being alkaline earth silicates.

The third gaseous constituent, nitrogen, is also estimated by the vacuum fusion process. The results check closely with ordinary chemical methods of analysis except where metallic titanium is present in the welding pool. It is shown that most commercial welds contain percentages of nitrogen in excess of 0.02% and that multi-run joints are heterogeneous in this respect. Much higher values occur, in many cases, in the top layers of a weld. Presence of nitrogen in weld metal has attracted the attention of numerous investigators from the early days of arc welding, but it does not seem that even yet its precise influence, in the small proportions in which it is found, has been definitely determined.

Practically the only real metallurgical development of mild-steel electrodes over the past ten years has been the introduction into flux coatings of constituents allowing higher manganese contents and lower nitrogen absorption

* Reprinted from the British publication, *Welding*.

in the weld metal. The improved physical properties result largely from this plus the fact that the weld metal is slightly cleaner than with some of the older fluxes. Since the carbon content of solid weld metal is low, nitrogen, even in small percentages, is still an important influence on the physical properties obtained.

Sulphur and Phosphorus

Macroscopic and microscopic examinations disclosed that sulphur prints taken from the weld metal were much paler and less distinctly marked than those shown by the adjacent plate metal, even when the quantities present in each case were similar. The distinction between the apparent physical conditions of the sulphur in the plate and weld has been shown not to be due to the presence of free sulphur in the weld or sulphur in any other form than a sulphide. Methods of analysis depending upon the evolution of the sulphur as sulphuretted hydrogen gave the same values of gravimetric methods in which the sulphur is oxidized during dissolution of the sample.

Concerning phosphorus, no definite evidence of any special features in the distribution of the element has been obtained. It seems possible that a certain amount of phosphate, possibly originating from the electrode flux minerals, is included in the non-metallic constituents of the weld metal. The bulk of the phosphorus in the weld metal, however, is probably in solid solution as in ordinary steel.

Porosity in Weld Metal

A defect to which weld metal is occasionally prone is the development of patches of porosity. The reasons for this are not always easy to determine. It is known that very many factors may give rise to this trouble—variable quality plate (especially plate high in sulphur content or showing undue segregation of impurities), faulty electrical or welding conditions or electrodes having damaged flux coatings. Eccentricity of flux and core wire can also cause porosity. There may, however, be still other causes.

The explanation may lie in the character of the weld metal itself. In the more obvious cases of porosity, for instance when welding is done on plate with surfaces having excessive moisture, paint, oil, etc., hydrogen is the probable source of the difficulty. Agents of the type mentioned are all sources of hydrogen, which is absorbed by the weld metal in excess of the capacity of the arc heat to expel it before the metal can solidify. Bad electrical or welding conditions, or mechanically unsatisfactory electrodes giving rise to an unstable arc, may result in the simple mechanical trapping of air in the weld.

Weld metal which is highly reduced may be subject to porosity due to a reaction between iron oxide or between the occasional larger non-metallic inclusions which react with the carbon present. In the latter case, the porosity arises from the generation of carbon monoxide. It seems very probable that this reaction accounts for the peculiar porosity observed in some welds using an anhydrous flux to which large additions of ferro-titanium had been made. Even though every possible source of hydrogen had been eliminated from the welds, it was found that the weld metal showed a series of holes along the centerline of the weld. When broken through, these holes were roughly conical in shape. The apices of the cones appeared to coincide in many cases with large non-metallic inclusions. This type of defect was more severe the more highly reduced the weld metal. It was noticeable that the metal was very sluggish in these cases, which would tend to hinder the separation of non-metallic inclusions. Highly reduced weld metal tends to have a higher carbon content than the more oxidized types and may thus be expected to give rise to a local "rimming" action more readily.

New Film—"This Is Resistance Welding"

A refrigerator evaporator being fabricated by seam welding

The two pictures reproduced herewith are close-ups from "This Is Resistance Welding," a new 16-mm, all-color sound movie produced by the Raphael G. Wolff Studios, Hollywood, under the technical supervision of the G-E welding laboratories, as part of General Electric's "More Power to America" program. The new film emphasizes the importance of resistance welding in the quantity production of thousands of products, which may range in size from a filament a thousandth of an inch thick to the massive steel shell of a railroad coach. It is available through electric utilities, welder manufacturers and G-E district offices for exhibitions without charge before engineering and manufacturing groups, technical societies, schools, etc.

Close-up of the projection welding of fans for large motors

New Products to Use

"Vibra-weld" gun for welding and peening ferrous and non-ferrous castings

"Vibra-Weld" Gun

THE "pencil weld" gun and the "Vibra-Weld" a-c welders are designed to salvage castings which otherwise have to be scrapped because of blowholes or other surface defects. The gun welds one particle of metal at a time to the surface and then peens it by vibrating action to assure a dense sound deposit. The combination of the gun and the special welder is said to provide fast, permanent fill-ins for ferrous or non-ferrous castings at temperatures which do not exceed 125 F. Grey iron and other ferrous castings can be quickly filled in with nickel rod; aluminum castings with pure aluminum rods. Press fits, such as on motor housings and wheels where the bearing race has become loose, can be easily repaired by depositing a light layer of metal on the casting and pressing the bearing into place. MID-STATES EQUIPMENT CORP., 2429 South Michigan Ave., Chicago 16.

☆ ☆

Drafting Instrument

A NEW time-saving drawing board known as the "Rapidesigner" has been developed to assist draftsmen and designers in the machinery fields. The board is made from transparent, laminated plastic sheets, and the markings inlaid between laminations so as not to rub off. Working on the stencil principle, this instrument may be used to prepare templates of standard gears, rivets, drill points, countersink points and various types of screws. It gives screw and rivet head sizes from 3/32 to ¼ in.; drill point and countersink angles 62,78,100 and 118; involute gear teeth No. 10 to 2; and rack gear sizes 13 to 3. RAPIDESIGN, INC., P. O. Box 592, Glendale, Calif.

Synchronous Motor Welder

UTILIZATION of the inbuilt separate exciter of the Hobart electric drive welder has resulted in the production of a compact synchronous motor welder. This unit can be started across the line and will automatically synchronize itself by the build-up of the separate exciter. A heavy squirrel-cage winding makes the motor as easy to start as a conventional induction motor. Once up to speed, the exciter builds up and automatically applies correct excitation to the motor fields.

Hobart synchronous welder. It has unity or leading power factor characteristics

This welder also can be used as an a-c generator to operate small tools, lathes, grinders, etc. In such applications, the shaft is coupled to a gasoline or electric motor. HOBART BROTHERS CO., Hobart Square, Troy, O.

☆ ☆

Telescopic Frame for Lift Truck

TO render its "High-Lift" hydraulic truck adaptable to higher stacking and tiering jobs, the LYON-RAYMOND CORP., 2757 Madison St., Greene, N. Y., has designed a telescopic frame which increases the elevated height of the platform to 84 in. In lowered position an overall height of 69 in. is maintained, allowing the truck to be moved through doorways and under overhead obstructions. The telescopic section is of the same tubular construction as the base frame.

☆ ☆

Gas Impurity Indicator

"DEOXO" indicator detects and measures both oxygen and hydrogen impurities in gases. It is ruggedly constructed and will operate over long periods with little or no attention, states manufacturer. The instrument is suited for either industrial or laboratory use. BAKER & CO., INC., Newark, N.J.

Portable air hoist for loads up to 1,000 lb

Air Hoist

A NEW lightweight, portable air-powered Keller hoist is designed for a multitude of lifting jobs in the ¼ and ½ ton capacity range. This 30-lb hoist has a lifting capacity of 1,000 lb at 17 ft per minute and proportionately greater speeds for lesser loads. KELLER TOOL CO., Grand Haven, Mich.

☆ ☆

Industrial Safety Equipment

A NEW line of industrial equipment is offered by American Optical Co. to give added protection to the plant and shop weldor. Among new products is a "Duraweld" goggle for weldors, a "Duralite" goggle for protection against flying objects, a chemical and dust goggle and a "fits-on" goggle for protecting spectacle lenses against pitting and scratching.

The new gloves include a weldor's glove, an open-back glove for women who perform light assembly work, an all-purpose glove for women workers, a heat glove for jobs requiring hot handling and an all-purpose glove for resisting rough wear.

A line of mittens includes those for drop forging, die-casting and bending block work, a steel-studded mitten for steel workers and an asbestos mitten for heat-treating operations. There is also a new cover-mitt that fits over gloves and mittens to add to their life and hand pads made to wear over cotton or light-weight gloves.

Other new products are a leather sleevelet, "Sta-Set" finger cots to protect both fronts and backs of fingers, two pairs of spats for foundry and chemical workers and a ladder shoe to prevent the accidents caused by creeping or skidding ladders. AMERICAN OPTICAL CO., Southbridge, Mass.

☆ ☆

Photographic Papers

THREE new industrial photographic papers which will speed the production of paper positives from engineering drawings have been announced by the EASTMAN KODAK CO., Rochester 4, N. Y. Known as "Reflex Copy TXA," "Linagraph Ortho TXA" and "Linagraph Blue Sensitive TXA," the new papers are translucent and of extra light weight so that they may be used in place of film negatives where rapid printing time in making subsequent positives are necessary. They can also be used for filing purposes or for binding into a book of drawings or printed matter.

3 Rod Saver Electrode Holders

FOR EVERY WELDING NEED

Give more ARC time

60° or 90° Angle Rod Hole

The Stubby and Master Rod Saver Holders are available with either 60° or 90° rod position holes; gives operator greater flexibility, makes close-quarter work easier.

CUB ROD SAVER

For lightweight operations through 180 amps. Compact and sturdy, only 8¼" long and weighing 11 ounces, handles rods up to 5/16".

STUBBY ROD SAVER

For general purpose work in all operations where capacity through 300 amps is desired. Handles electrodes to ¼". STUBBY'S length is 8¾", weight only 16 ounces.

MASTER ROD SAVER

For heavy duty welding with capacity of 400-500 amps. Operates under sustained conditions using 5/16" electrodes. The MASTER weighs 19 ounces, is 10½" long.

Martin Wells

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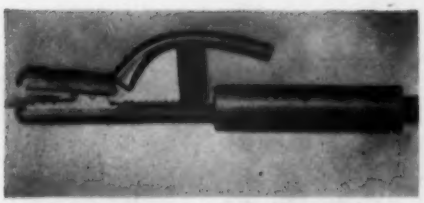


"Tweeotong" electrode holder with all replaceable parts. It resists impact and heat

Electrode Holders

"TWECOTONG" electrode holders are featured by an almost indestructible molded-laminated glass cloth Bakelite insulation keyed to the holder casting. The tensioning spring is firmly seated on fibre upset washers and is protected from spatter by non-binding Neoprene tubing. The tongs are made of high-copper alloy for maximum conductivity, and the jaw groove pattern permits electrodes to be held at any desired position including end grip. All parts are replaceable.

These holders are offered in both full-insulated and semi-insulated models. The full-insulated models are known as No. A-14, 300-amp, ¼-in. electrode capacity and No. A-38, 500-amp, ⅜ in. electrode capacity. The semi-insulated models are: No. B-14, 300-amp, ¼-in. electrode capacity and No. B-38, 500-amp, ⅜ in. electrode capacity. TWECO PRODUCTS CO., English and Ida Streets, Wichita 7, Kansas.

☆ ☆

Pneumatic Wrench

THE new "Thor" pneumatic-impact wrench drives and removes nuts, bolts and cap screws up to ⅜ in. in diameter. Said to be the smallest and lightest wrench ever developed, it is designed to provide full striking power for one-hand operation. The rotatively striking impact jaws are set at a wide radius from the spindle center to reduce stress, and a short, rigid spindle shank delivers the blow close to the work. This compact tool weighs but 3¾ lb and measures 5⅞ in. in length. INDEPENDENT PNEUMATIC TOOL CO., 600 West Jackson Blvd., Chicago 6.

"Thor" pneumatic wrench for driving and removing nuts, bolts and cap screws up to ⅜ in.

☆ ☆

Flexible-Shaft Grinder

OPERATING at a free speed of 17,000 to 18,000 rpm, the new "LeighVB-2" flexible-shaft grinder can be used for delicate "hospital" applications or for heavy work on the production line. It has been found excellent for accurate light-hand grinding, burring, trimming (brass and die castings) filing, finishing and polishing and equally efficient for cutting ferrous and non-ferrous materials.

"Leigh VB-2" high-speed flexible-shaft for heavy or delicate work

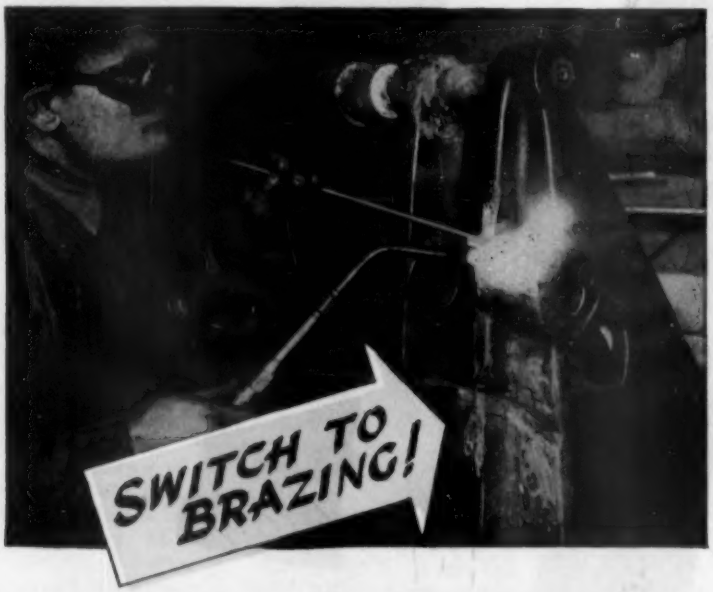
The spindle accommodates all types of standard grinder points and wheels. It also has a ¼-in. collet and can be fitted with auxiliary reducing collets which accommodate ⅛, 3/32 and 1/16 arbors. The ¼-hp motor (a-c/d-c type) is provided with an end ring for suspension and a rubber-footed base for bench use. SPRING SPECIALTY CO., 1219 West Madison Street, Maywood, Ill.

☆ ☆

Gas Welding Flux

"FLUXINE No. 5" is the name of a new flux for gas welding with bare steel rods. This flux causes the metal to flow freely and evenly and to penetrate deeply into the joint without porosity. It produces a smooth, soft, and easily machined weld. KREMBS & Co., 669 West Ohio Street, Chicago 10.

(Continued on page 82)



PUSHER BRACKET REPAIRED WITH

BRIDGEPORT BRONZE

Heavy machinery can be quickly repaired and put back into service, often stronger than in its original condition. Illustrated is one of two brackets on a pusher which handles thousands of pounds of metal. The bad breaks were quickly repaired with Bridgeport's #192 low-fuming rod, saving many weeks delay. Another pusher bracket with somewhat similar breaks, also repaired with #192, has now been in operation for many months without any sign of failure.

Brazing with Bridgeport Bronze requires only local pre-heating of the base metal to a cherry red; therefore, dangerous stresses are not set up and time is saved because general pre-heating and slow cooling are not required. Frequently, the brazed part is tougher and more ductile than the original section.

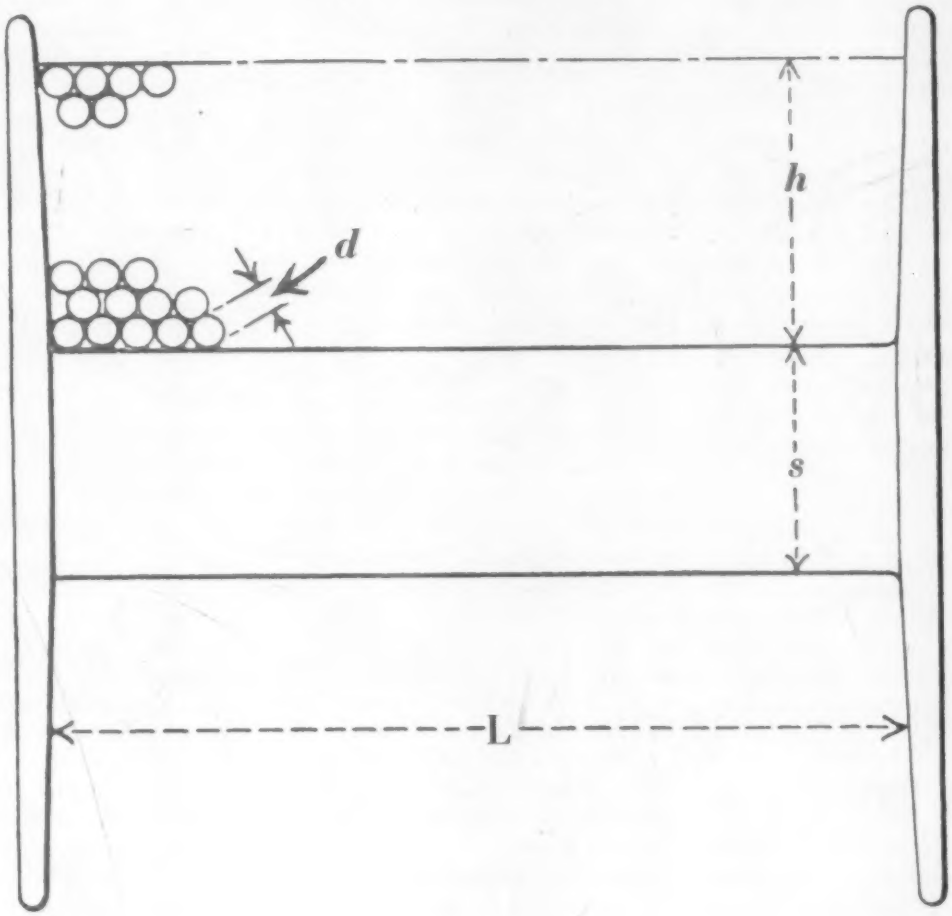
Bridgeport Bronze Rods are free-flowing and have exceptional adhering properties producing strong ductile repairs of both light and heavy-duty equipment. Write for Bridgeport's Bronze Welding Manual containing many practical suggestions.

"Bridgeport" BRIDGEPORT BRASS COMPANY
BRIDGEPORT 2, CONN. • Established 1865

Bronze Welding Rod A PRODUCT OF
BRIDGEPORT BRASS

How Many Feet in a Reel?

By W. F. SCHAPHORST



It is often desirable to ascertain the total length of rope, cable, wire or hose which may be stored on a reel without actually measuring the piece. This can readily be approximated by the formula given in the right hand column.

A rope, cable, hose or wire wound upon a drum or a reel naturally assumes such a position as indicated in the accompanying sketch; that is, the winding on top of the first layer seeks the valleys between the turns, especially if the wire is taut, and likewise for the second and subsequent layers. In this way the maximum length is wound onto the drum.

A further condition, however, must be borne in mind. When materials are reeled, the layers are alternately right and left hand spirals. Consequently, they cannot bottom as ideally as indicated in the illustration. In view of this fact, a correcting factor of 0.262 enters into the formula. The complete formula for determining the number of feet of material wound on the drum is, therefore:

$$F = \frac{(h + s) \times h \times L}{(d)^2} \times 0.262$$

where F is the total number of feet, h the depth of material on the drum in inches; s the diameter of the drum in inches, L the length of the drum in inches, d the diameter in inches of the rope, wire, hose or cable.

Example: How many feet of ½-in. wire rope will be wound on a drum 50 in. long by 20 in. in diameter when the rope is wound to a depth of 10 in.? Substituting these numerical values in the formula gives:

$$F = \frac{(10 + 20) \times 10 \times 50}{(0.5)^2} \times 0.262$$

$$= \frac{15{,}000}{0.25} \times 0.262$$

$$= 15{,}720 \text{ ft}$$

THE WASHINGTON NOTEBOOK

JUNE finds Washington still in a state of confusion as to what is to be done or what is to be expected. The nation is still concerned with the tension which continues to exist in labor-management relations. In the nine months since V-J day, industry has been torn by continual strife, which began with the General Motors walkout of 180,000 workers in November. That was the beginning of the first great strike of the reconversion period.

In January 800,000 steel workers left their jobs, followed on April 1 by 400,000 soft coal miners. A temporary truce was called in the coal strike in mid-May, but not before it had brought production to a halt in many of the country's production centers.

The Government took over the soft coal mines in the early morning hours of May 22nd. Secretary of the Interior Krug was directed to seize and operate the mines. Up to the time this was written, however, the miners were uncertain as to whether or not they would work for their Government.

Railroad Imbroglio

On May 18th the President took over the railroads because of the unwillingness of the engineers and trainmen to accept an increase of 16 cents an hour recommended by a Government fact-finding board. The desired wage was 18½ cents an hour, and it is difficult to determine why such a wage was not recommended since it seems to be the national standard. An 18½-cent increase, later offered by the President failed to avert the strike.

Other threats to the nation's economy in the offing are the possibility of a strike among hard coal miners and the walkout tentatively set for June in the shipping industry.

These repeated disasters come at a time vital in our reconversion production battle against inflation. Automobile production, which was expected to reach the prewar peak rate of 3,577,292 cars annually by last March, was actually at the rate of 750,000 annually in the week ending May 11. This means that thousands who would purchase automobiles won't be given the opportunity this year.

Silver Bloc Active

Metals—particularly non-ferrous metals—are in the Washington news. A compromise measure has been approved by a Senate appropriation subcommittee permitting the Treasury to sell silver at 90.3 cents an ounce as compared to the wartime domestic price of 71.1 cents an ounce. It is believed there is good chance of passage, which means the Western congressmen will have attained another step toward their asserted goal of $1.29 an ounce for silver. So far as the welding industry is concerned, any increase in silver prices will, of course, be reflected in increases in the price of silver-brazing alloys.

Interest is also expressed in the fact that in England, for the first time in history, the price of aluminum (12.07 cents a lb) is less than the price of copper (12.97 cents a lb). What will happen here if strike settlements in the copper industry bring the present 15 cents a lb for aluminum closer to 12-cents-a-lb copper?

There is increasing talk about new wage demands if the OPA price control plan is curtailed by Congressional action. If price control is extended, it can be expected that June will see further decontrol orders. The first list of capital goods items removed from price control represented approximately $3 billion of the estimated $15 billion value of capital goods expected to be produced this year.

Planes and Atomic Bombs

Before long both Bell and Douglas can be expected to be announcing supersonic planes. The first announcement may come from Bell with a plane capable of speeds greater than 800 mph.

Another development which Washington is watching with interest and speculation is the forthcoming atomic-bomb test at Bikini. Though there was talk after the first postponement that the test would never take place, there are no such hints about Washington now. Plans are well underway for the test against Naval craft, and most of the observers have already left for the South Pacific. The first test bomb will be air-dropped in July. The second test calls for surface or subsurface detonation in August.

The preparation of the target ships and the measurement of ship damage will be in the hands of a technical staff of nine divisions. These divisions are: (1) bomb operation; (2) blast, pressure and shock; (3) wave motion and oceanography; (4) electromagnetic propagation and electronics; (5) radiological safety; (6) radiometry; (7) radiation; (8) remote measurements; and (9) technical photography.

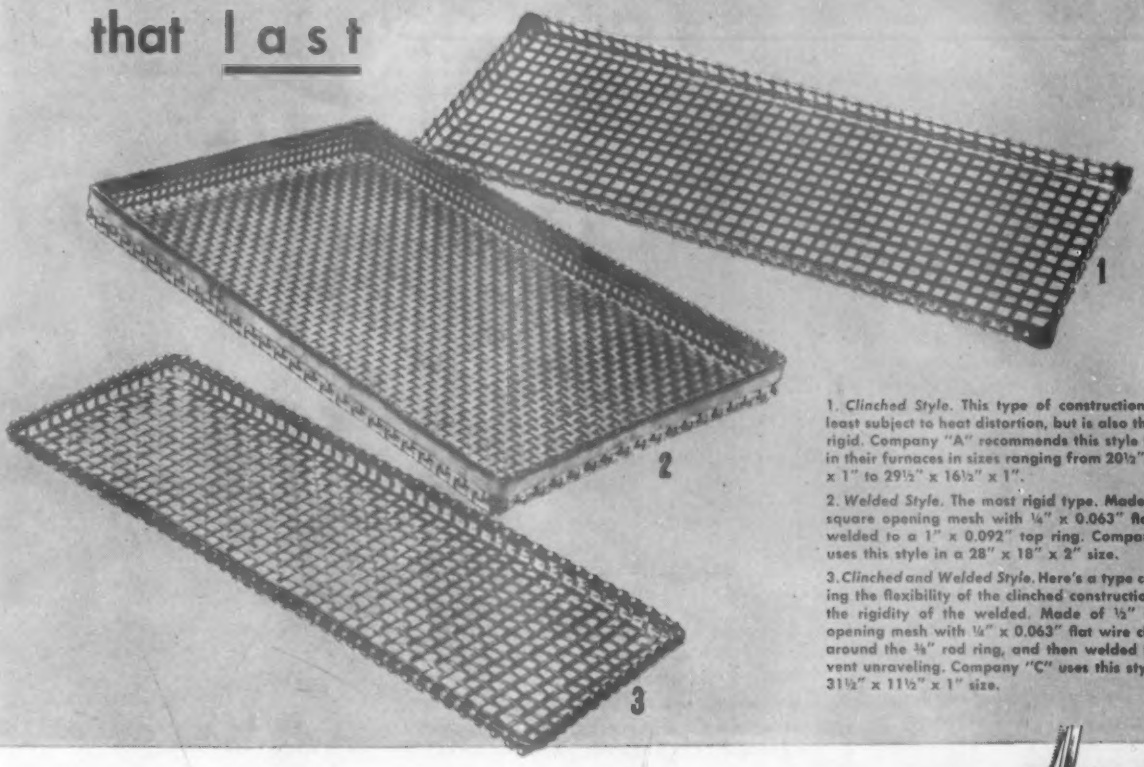
Steel Production Losses

The coal strike resulted in a loss of approximately 2,000,000 tons of steel ingot and steel for casting up to May 20. This is only a part of the total loss, for even after the strike ends some time will be required to restore the steel industry's operations to prestrike levels.

First quarter reports of industrial operations show that of 111 important industrial concerns, 67 companies showed increased earnings while 44 experienced decreases in their earning power. The aggregate earning of the companies studied, however, indicated an earnings decline of approximately 25% despite the earnings increase experienced by 60% of those studied. This was due to the losses suffered by a few very large organizations. Those industries hardest hit were: automotive, metals and mining, steel and railroads.

The Veterans' Administration has published a booklet listing a total of 162,485 student openings for next fall in 1,029 colleges, universities and professional schools for which veterans' applications will be accepted. Most of the openings are in smaller colleges, and geographically they include institutions in all states except Wyoming. Every VA field office has the list.

3 Ways to make BRAZING TRAYS that last



1. *Clinched Style.* This type of construction is the least subject to heat distortion, but is also the least rigid. Company "A" recommends this style for use in their furnaces in sizes ranging from 20½" x 6½" x 1" to 29½" x 16½" x 1".

2. *Welded Style.* The most rigid type. Made of ¼" square opening mesh with ¼" x 0.063" flat wire welded to a 1" x 0.092" top ring. Company "B" uses this style in a 28" x 18" x 2" size.

3. *Clinched and Welded Style.* Here's a type combining the flexibility of the clinched construction with the rigidity of the welded. Made of ½" square opening mesh with ¼" x 0.063" flat wire clinched around the ⅜" rod ring, and then welded to prevent unraveling. Company "C" uses this style in a 31½" x 11½" x 1" size.

All - INCONEL brazing trays . show longer life at the high temperatures used in brazing

Thermal endurance, strength, ductility and *resistance to oxidation and corrosion* are the properties that make Inconel* "standard" for many high-temperature applications.

And, here you see how Inconel goes to work to make long-lived brazing trays that cut replacement and minimize operating interruptions.

The trays shown represent the three principal types of construction supplied to order by ROLOCK, INC. of Fairfield, Conn. Used at brazing temperatures of 2050° F., these all-Inconel trays have outlasted and out-performed other materials previously used. In fact, all through brazing equipment, you'll find parts being made of Inconel . . . to ensure long, trouble-free service.

For more information on the metal that fights high heat . . . oxidation . . . corrosion . . . mechanical abuse . . . write for your copy of *"For Long Life at High Temperatures."* The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y.

*Reg. U. S. Pat. Off.

INCONEL—for long life at brazing temperatures

(80 NICKEL - 14 CHROMIUM)

Short Cuts and Kinks

Cutting-Torch Guide

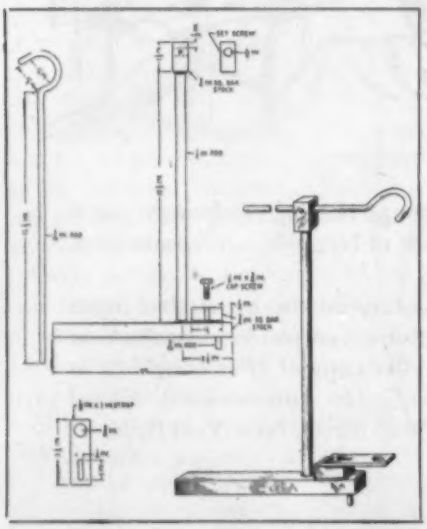
By H. P. Martin

SMOOTH, true cuts on circles or circular segments of small radius can be made easily with a hand-operated guiding device for a machine cutting torch. Many shops will find it useful for doing work that usually requires larger, more elaborate equipment.

The particular guide sketched was made especially for cutting rounded ends on structural steel pieces used in the manufacture of ice-chipping machines, but the idea can be adapted to the needs of almost any job calling for small circles by varying the dimensions given in the drawing. It should be noted that the radius is limited by the distance between the ¼-in. slot and the ⅝-in. hole in the tip-supporting bar. The guide can be used to cut circles of smaller or larger radius by decreasing or increasing the length of this bar from the 3¼-in. length specified.

The parts of this device were made according to the specifications given. The tip-supporting bar was fastened to the base by means of a cap screw and washer, and the vertical member was brazed to the top of the base 2½ in. from the end. The torch hook was inserted through the hole in the block at the top of the vertical member and secured with an Allen setscrew when the torch was properly positioned.

This circle cutter is simple to operate. The center of the circle or segment to be cut is located on the plate and drilled to accommodate the pivot pin, a ⅜-in. rod on the base of the guide. The pivot pin is inserted in the center hole, and the cutting torch is positioned and carefully adjusted for the desired radius. The setscrew on the hook and the cap screw on the base are then tightened. Once the cut has been started, the operator needs only to move the assembly around the pivot at the correct cutting speed.



Courtesy, The Linde Air Products Co.

By changing the dimensions given in the drawing, this guiding device can be adapted to almost any job calling for small circles

Do you know of a better way to do it—a way that is faster, easier or more economical than the method usually followed? If you do, why not pass it along? Send anything you think suitable for this section to: Short Cuts and Kinks, The Welding Engineer, 520 North Michigan Ave., Chicago 11. Payment will be made at our usual rates.

☆ ☆

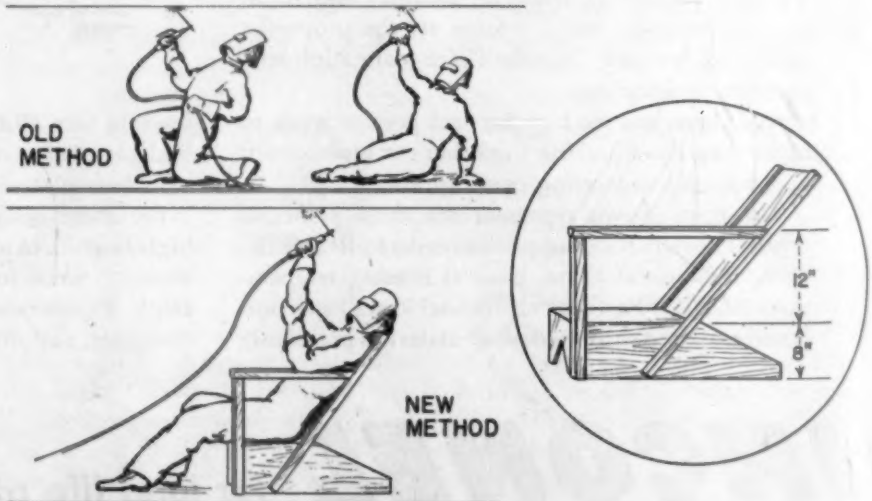
Weldor's Chair

By R. F. May

A WELDOR required to do continuous overhead welding is forced, as a rule, to assume awkward positions which cannot be held for any length of time. While at Marinship, I submitted a suggestion to the War Production Drive Committee for a weldor's chair. This is a comfortable low chair with an inclined back and a single arm rest which allows the weldor to support his welding arm.

The accompanying sketches picture the weldor's chair and compare the old and new methods of overhead welding. It can readily be seen how much easier it is to work in the "new" position.

As a result of the adoption of this suggestion, weldors at Marinship were able to make twice as much footage overhead. They were not subject to back strains and fewer rest periods were needed.



Chair designed to speed up overhead welding. Note the relaxed position of the seated welder

☆ ☆

Federal Shipbuilding and Dry Dock Co. uses this device to cut out samples for testing

Weld Probing

A SHIPYARD "stool pigeon" tattles on false or faulty welding in U. S. Steel Corporation's Federal shipyard at Kearny, New Jersey. This is Federal's newest safeguard against weak seams in prefabricated vessels. The pigeon (weld prober) is tack welded to the seam to be tested, and an electrically driven, saucer-shaped blade cuts out a 3 to 4 in. section of weld bead. The samples are then analyzed for flaws, changes in density, physical markings, etc. Subsurface defects are easily detected in this fashion. Federal also uses X-rays to spy on internal defects.

PAGE *Welding* ELECTRODES

Welding Economy Begins in the Front Office . . .

The right electrode . . . correct welding technique—these add up to economy in production welding. Page offers both: A complete line of electrodes and gas rods (with emphasis on PAGE-Allegheny stainless steel)—plus the benefit of the experience of PAGE selected distributors and PAGE Service Engineers. For uniformly high quality electrodes and rods and information about their most efficient use—get in touch with your PAGE distributor.

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Bridgeport, Conn.

TRADE MARK

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

In a welding electrode it's the angle of the point that determines speed and uniformity in carbon arc welding or cutting operations. Hold-Ark Electrodes hold the original wide-angle tip that concentrates the arc for hotter, more uniform welds. They don't spindle as they burn down.

In automatic or hand welding, Hold-Ark Carbon Electrodes do more work. They produce 13% more welds per inch of rod, because their current capacity is high—burning is *slow*, thanks to that lasting wide-angle tip again!

Hold-Ark Electrodes are strong, too. They stand up under mechanical shock and abuse — reduce work slowdowns due to breakage while welding.

Find out for yourself how Hold-Ark Electrodes can put speed and uniformity . . . and economy, too . . . into your carbon arc welding and cutting jobs. Let a trial lot convince you.

SPEER
CARBON COMPANY
ST. MARYS, PA.

CHICAGO • CLEVELAND • DETROIT
MILWAUKEE • NEW YORK • PITTSBURGH

887

NEW PRODUCTS TO USE

(Continued from page 76)

Elgin arc welder with radio dial heat control

A-C Arc Welders

THE improved series WB Elgin portable a-c welders are said to produce a smooth flow of current for ease of operation and to strike and maintain a flexible and obedient arc. Special features are a scientifically designed cabinet which gives adequate ventilation at all times and a "heat range" control that reduces the time required to change current settings to a minimum. Plugs and cables have been eliminated by a radio-type dial located on the top of the welder.

Model B-150 has been designed for all types of sheet-metal work and for use by automobile body and fender shops, garages and general repair shops. It will weld light sheets and all the heavy work that may be required in this particular field, using 1/16 to 5/32 in. electrodes.

Model WB-200 is readily adapted to all types of general work in the automotive and industrial fields. It welds light sheets to heavy steel, employing 1/16 to 3/16 in. electrodes.

Model WB-250 is made for all types of work and for use in iron works, garages, repair shops, factory maintenance, etc. Its substantial construction also makes it a practical welder for factory production work. It will weld light and heavy sheet steel with 1/8 and 1/4 in. electrodes. BORM MFG. CO., 25 Union St., Elgin, Ill.

☆ ☆

Welder with A-C Generator

A NEW 300-amp gasoline-driven arc welder is equipped with an inbuilt auxiliary a-c generator to supply power at 110 or 220-volts, 60 cycles, single or three phase. An oversize separate exciter serves both the welding generator and the auxiliary a-c generator. The panel of the latter provides receptacles and studs for connecting an a-c voltmeter with dual scale, frequency meter and rheo-

CHAMPION
BLUE DEVIL ELECTRODES
(Recommended wherever weld metal of high quality is desired)
USED ON THIS PLANT YARD PIPE JOB!
CHAMPION Blue Devil Welding Electrodes E-6010 represent the most advanced development of the shielded arc type with a high over-all deposit efficiency obtained due to minimum splatter. Excellent penetration makes the Blue Devil especially satisfactory for welding rusty and dirty steel and for field work. For an all-position electrode of outstanding characteristics in construction of ships, bridges, buildings and all types of steel structures—use CHAMPION Blue Devil Electrodes.
Metallurgical tests make CHAMPION WELDING ELECTRODES the leading choice of fabricators who insist upon uniformly satisfactory results and increased production.
WELDING ACCESSORIES
CHIPPING GOGGLES
WELDING MACHINES: A. C. TRANSFORMER TYPES
WELDING GOGGLES
WELDING CLEANING TOOLS
WELDING CLAMPS
SAFETY CLOTHING
WELDING GLOVES
CARBON PASTE & FLUXES
WELDING CABLE CONNECTORS
WELDING CARBONS
CARBON PLATES
WELDING CABLE
WELD SPATTER ELIMINATOR
ELECTRODE HOLDERS
THE CHAMPION RIVET COMPANY
WELDING ELECTRODES

THE CHAMPION

RIVET COMPANY

CLEVELAND, OHIO — EAST CHICAGO, IND.

For Prompt Service on
SAFETY Equipment
Phone your Willson Distributor

In this list you'll find one of your neighbors—a distributor of WILLSON Personal Safety Equipment. That distributor, backed by our 75 years experience in safety service, is well qualified to help you on any eye and respiratory safety problem. That distributor, in addition, maintains a local stock of WILLSON safety equipment to give you what you want—when you want it.

ALBUQUERQUE, N. MEX.—Hendrie & Bolthoff Mfg. & Supply Co.
ATLANTA, GA.—Fulton Supply Co.
BALTIMORE, MD.—Carey Mach. & Sup. Co.
BIRMINGHAM, ALA.—Safety Engineering & Supply Co.
BOSTON, MASS.—Cutter, Wood & Sanderson Co.
BUFFALO, N. Y.—American Allsafe Co.
BUTTE, MONT.—Montana Hardware Co.
CASPER, WYO.—Casper Supply Co.
CHARLESTON, S. C.—Cameron & Barkley Co.
CHARLESTON, W. VA.—Safety First Supply Co.
CHATTANOOGA, TENN.—C.D. Genter Co.
CHICAGO, ILL.—Protective Equipment, Inc.
CINCINNATI, OHIO—The E. A. Kinsey Co.
CLEVELAND, OHIO—Safety First Supply Co.
COLUMBUS, OHIO—The E. A. Kinsey Co.
DAYTON, OHIO—The E. A. Kinsey Co.
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DENVER, COLO.—Hendrie & Bolthoff Mfg. & Supply Co.
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GREENVILLE, S. C.—Carolina Sup. Co.
HICKORY, N. C.—Smith-Courtney Co.
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INDIANAPOLIS, IND.—The E. A. Kinsey Co.
JACKSONVILLE, FLA.—Cameron & Barkley Co.
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LOS ANGELES, CALIF.—E. D. Bullard Co.
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MUSKEGON, MICH.—Factory Supply Co.
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OKLAHOMA CITY, OKLA.—Hart Industrial Supply Co.
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PHILADELPHIA PA.—Industrial Prod. Co.
PITTSBURGH, PA.—Safety First Supply Co.
PORTLAND, ORE.—J. E. Haseltine & Co.
PROVIDENCE, R. I.—James E. Tierney
RICHMOND, VA.—Smith-Courtney Co.
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ST. PAUL, MINN.—Farwell, Ozmun, Kirk & Co.
SALT LAKE CITY, UTAH—Industrial Supply Co., Inc.
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SPRINGFIELD, MASS.—Charles C. Lewis Co.
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TULSA, OKLA.—Hart Ind. Supply Co.
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GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE **WILLSON**
PRODUCTS INCORPORATED
READING, PA., U.S.A. *Established 1870*

Hobart's 300 amp gasoline-driven welder with an auxiliary a-c generator

stat for controlling the voltage. The auxiliary generator is available in two sizes, 6 and 12 kw. HOBART BROTHERS Co., Hobart Square, Troy, O.

☆ ☆

Carbon Determinator

A NEW type of volumetric carbon determinator has been developed to aid metallurgists in analyzing the carbon content of iron, steel, heat-resisting steel, stainless steel and other ferrous materials. The precisely graduated, water-jacketed burette is mounted in front of a fluorescent light for easy reading. Accuracy is one point or better, claims manufacturer. The absorption chamber permits complete absorption in two passes; for many alloys one pass is sufficient. LINDBERG ENGINEERING Co., 2444 W. Hubbard St., Chicago 12.

Carbon determinator for analyzing iron, steel, heat-resisting steel, etc.

☆ ☆

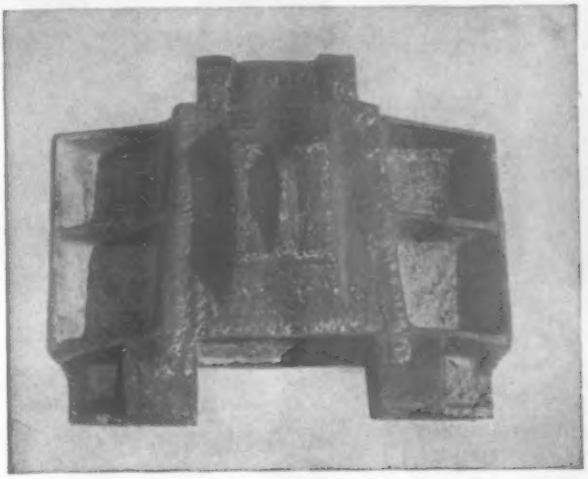
Flexible couplings for the quick joining of individual sections of ventilating hose

Ventilating Hose Coupling

A SIMPLE, fool-proof coupling makes possible the "10 second" joining and disconnecting of individual sections of flexible ventilating hose. The coupling is built into the hose, eliminating the need of fittings. A flat spring steel collar is first compressed to slip inside the end of another section and then released, forming a tight joint. Disconnection is simply made by compressing the inner spring steel collar and withdrawing the male end.

These couplings are covered with a fire-resistant duck fabric which has been coated with a durable thermoplastic. They are furnished in standard diameters from 3 to 16 in. and in lengths of 10, 15, and 25 ft. THE WARNER BROTHERS Co., SPIRATUBE DIVISION, Bridgeport 1, Conn.

ROUGH SURFACES *or smooth*



Stoody Self-Hardening is a typical alloy widely used on heavy equipment for combatting earth abrasion combined with impact. Deposits can be left in the rough condition—need no subsequent machining. The power shovel track pad illustrated herewith is typical of its many uses—at least doubles usual life! Use Stoody Self-Hardening to cut replacements on all manganese steel equipment including power shovel parts, tractors, bull dozers, crushers and parts which must be forged after hard-facing is completed.

For wearing parts subjected to heat, impact and corrosion—and where deposits must be smoothly machined—choose Stoody 6, a hard-facing alloy retaining its hardness even at red heat. Stoody 6 is a non-ferrous alloy, resists corrosion, has good hardness and wear resistance when applied by either electric or oxyacetylene welding equipment; and can be readily machined with sintered carbide tools. Use Stoody 6 on hot punching dies (illustrated), exhaust valves, high temperature—high pressure flow valves, refractory dies, etc.

STOODY ALLOYS fight abrasive wear!

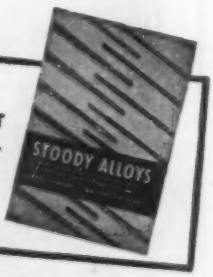
WHETHER YOUR wear problems result from abrasion, heat, corrosion, impact or a combination of all four, they can be solved with one of the many Stoody Hard-Facing Alloys. These alloys are available in types having a wide range of physical characteristics. Their use increases equipment life from two to ten times or more, reduces spare parts requirements, saves hours of costly downtime!

Stoody Alloys are applied by ordinary welding equipment to all wearing surfaces—combat all types of earth abrasion, metal-to-metal friction; lengthen life of parts subjected to corrosive media, heat and other sources of wear. *If you want longer life and improved performance from your equipment, find out how Stoody-Facing Alloys can help you!* Outline your problem and mail it to our engineering department. It's maintained to help you.

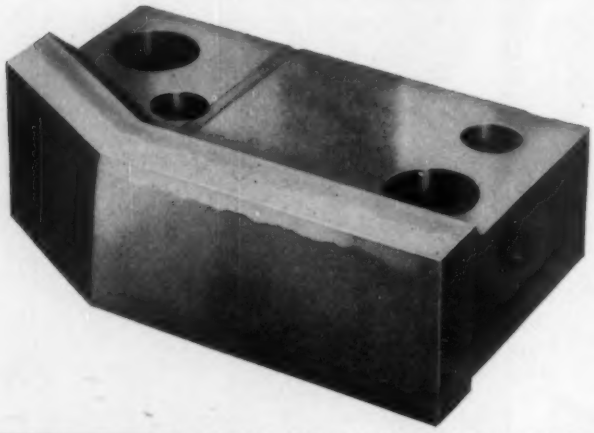
STOODY COMPANY
1148 West Slauson Avenue • Whittier, California

STOODY HARD-FACING ALLOYS
Retard Wear **Save Repair**

WRITE FOR FREE, DESCRIPTIVE BOOKLET
on all Stoody Hard-Facing Alloys. Describes physical properties, gives typical examples and recommendations for use of each alloy—an invaluable guide to all users of hard metals!



Compositely fabricate dies . . . by WELDING



(Above) Composite-Fabricated Die. The Base is Mild Steel, the Cutting Edges "Hard-As-Welded" Deposits of Eureka Oil Hardening Tool Steel Electrodes.

EUREKA TOOL AND DIE WELDING ELECTRODES, for composite die fabrication, facilitate planning and effect speedy results. Plain carbon, S.A.E. or low alloy NE steels are used as a base and weld deposits of the various Eureka Tool and Die Welding Electrodes constitute the cutting edges or working areas. Units so constructed efficiently replace those constructed entirely of tool steel.

ELIMINATION OF HEAT TREATMENT
Deposits of Eureka Electrodes, which are "hard-as-welded" eliminate the need of complete heat-treatment after welding.

COSTLY MAINTENANCE AVOIDED
The ability to produce a composite tool or die results in a working surface of any desired characteristic with a resilient core.

CONVERTING INTO COMPOSITE UNITS
Convert existing tool steel die sections into composite units to meet unusual conditions.

MACHINING IS FINAL OPERATION
In composite fabrication by welding, finish machining, drilling, etc., can be done as final operations.

INSERTS ELIMINATED
Composite fabrication by welding eliminates the use of inserts, which are often too costly, unsatisfactory or impractical.

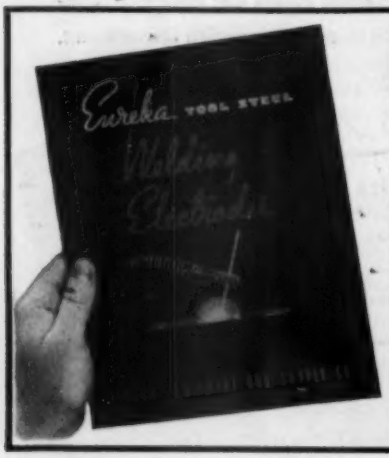
MULTIPLE APPLICATIONS
In composite fabrication by welding, it is practical to weld two, three or four types of unlike materials on one die unit to perform individual functions.

Also Facilitates Repairs to Die Units.

Eureka Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

223 LEIB STREET • FITZROY 3715 • DETROIT 7, MICHIGAN



FREE *Just clip and mail the coupon below for your free copy of our latest 40-page illustrated booklet, which will help you save many valuable man hours and minimize production delays.*

WELDING EQUIPMENT & SUPPLY CO.
223 LEIB ST.
DETROIT 7, MICHIGAN
Rush me your catalog:

NAME_____

TITLE_____

ADDRESS_____

CITY_____ STATE_____

"Badger" welder filter to eliminate dust, welding slag, etc. from moving parts

Welder Filter

THE elimination of mill scale, welding slag and other atmospheric dust in d-c welders through the use of Badger welder filters is said to result in substantial savings. Case histories tell how maintenance costs were reduced $3,000 in a plant with 55 welders and how another plant with 18 welders saved an average of 160 man-hours and machine-hours per unit usually lost in downtime. These filters are designed to fit all standard motor-generator welders operating on 25-50 and 60-cycle current. The filter media used is said to have a high dust-holding capacity, to be low in air resistance and to be constructed for long, hard usage. THE BADGER CORP., East Brown Street, Milwaukee 12.

☆ ☆

Manganese-Bronze Rod

A NEW low-fuming manganese-bronze welding rod is offered for hard-facing applications in which a hard bearing surface is necessary to resist abrasion. It can be used on grey cast-iron and steel, malleable, wrought and white cast-iron and on galvanized materials.

This rod melts at a low temperature, and a minimum of preheating is necessary on most applications. It thus enables fill-in deposits to be laid on cast-iron pistons, gear teeth, stripped threads, etc., while the casting is in place. It has good tinning properties and will flow smoothly even over greasy or rusty surfaces, states manufacturer. TITAN METAL MFG. CO., Bellefonte, Pa.

☆ ☆

Portable Tong Brazer

A PORTABLE 10-kva incandescent-carbon brazer somewhat similar to the 5-kva unit announced in the May issue of THE WELDING ENGINEER, is offered for the production of joining copper or copper alloy parts. These brazing tongs are cooled by a natural air draft that enters at the bottom, passes over the transformer and is expelled through louvered openings at the top. The

15,300 lb. mill housing repaired by brazing

at one-third the cost of a new casting

1) **To replace this** *15,300 pound cold rolling mill housing would have taken two months—too long a shutdown when every pound of production was vital to the war effort.*

2) **Instead it was brazed** *with 250 pounds of ⅜" diameter Chase low fuming bronze rod. In this close-up of the fractured casting the repair braze can be plainly seen.*

3) **One week later** *the repaired housing is assembled, and the rolling mill back in operation. Cost of brazing: about one-third the cost of a new housing.*

THIS is another instance—one of many such case histories on file—of how Chase Bronze Welding Rods save man-hours and cut costs ...insure fine quality welds wherever used in industry today.

TO FIND OUT MORE about Chase welding and brazing rods, write, on company letterhead, for complimentary copy of our handbook, "Chase Welding Rods—and Welding of Brass, Copper, Bronze." Simply address: Chase Brass & Copper Co., attention Dept. WE-66.

Chase

BRASS & COPPER CO.

INCORPORATED

Waterbury 91, Connecticut

SUBSIDIARY OF KENNECOTT COPPER CORPORATION

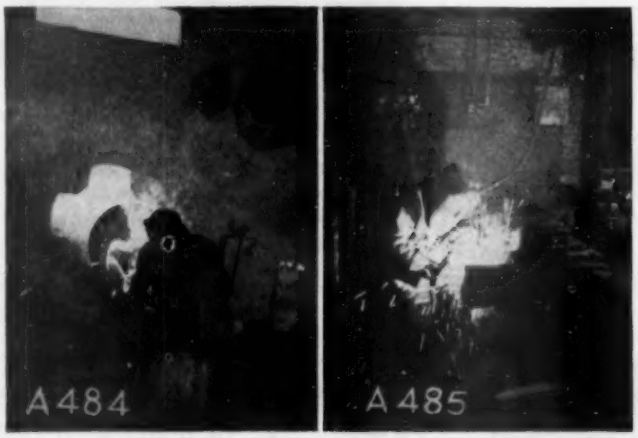
This is the Chase Network—handiest way to buy brass

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO.† LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON† *(†Indicates Sales Office Only)*

Life of Rolling Mill Wearing Parts Increased 6 to 8 Fold by Conservation Welding...

Rolling mill coupling boxes, spindles and crabs, whether made of manganese steel or carbon steel, are given added service life, and replacement cost figures for these members are substantially reduced through the application of Amsco Welding Products.

The coupling box shown in Picture A-484, which is cast of austenitic manganese steel, is being built up with Amsco Nickel-Manganese Steel Welding Rod. Obviously, it is quite difficult to grind the surface of the deposited weld metal due to the cramped quarters inside a coupling box. But the fact that manganese steel work hardens and polishes while the coupling box is in service, minimizes the necessity of finishing, grinding or peening. This is especially true if the wabblers of the opposing spindle, crab or roll, as that shown in Picture A-485, are built up or hard-faced with Amsco Economy Hardface.



The ground surface of Amsco Economy Hardface, being slightly harder than work-hardened manganese steel and having a Brinell hardness of between 450 and 550, takes on a high polish, with the result that very little friction is set up between it and the Nickel-Manganese Steel surface, which work hardens to between 400 and 500 Brinell.

Picture A-486 shows an ordinary carbon steel tight crab that has been built up with Amsco Nickel-Manganese Steel electrodes. At another rolling mill, the superintendent states that it is standard practice to purchase ordinary carbon steel crabs and build them up with Nickel-Manganese Steel after they have become worn, and that they obtain six to eight times as much service life from wabblers reconditioned with Nickel-Manganese Steel rod as from carbon steel.

Send us your problem for the application of Amsco Welding Products to the reclamation, hard surfacing and repairing of ferrous equipment parts.

•

(Amsco Welding Products are produced and sold in Canada by Canadian Ramapo Iron Works, Inc., Niagara Falls, Ontario.)

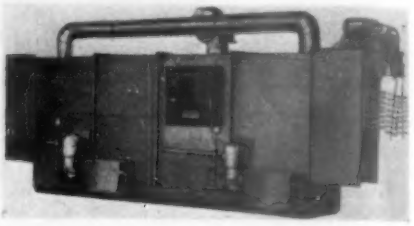
AMSCO
Foundries at
Chicago Heights, Ill.; New Castle, Del.;
Denver, Colo.; Oakland, Calif.;
Los Angeles, Calif.; St. Louis, Mo.
Offices In Principal Cities
AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS • ILLINOIS
AMERICAN Brake Shoe COMPANY

unit weighs 100 lb and is connected to a 220 or 440-volt source for single-phase, 60 cycle operation. A two-pronged plug-in switch is provided to change the brazing voltage to 12, 10 or 8 volts. Four large caster-type wheels and two convenient handles permit the unit to be quickly moved or carried to any part of the plant. WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, Pittsburgh 30.

☆ ☆

Metal Washing Machine

HANDLING large numbers of metal parts on racks is now facilitated by the new continuous-type washing machine having an output of about 60 racks per hour. It can be used as a single-stage washer or to handle a number of successive operations such as alkaline, acid or neutral dips. Connection may be made to an exhaust to remove fumes, unpleasant odors or excessive heat. OPTIMUS EQUIPMENT CO., 249 Church Street, Matawan, N. J.

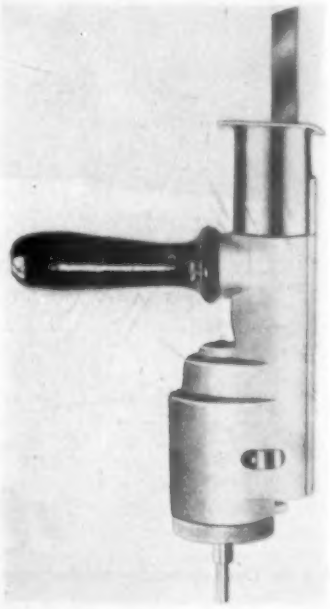


Metal washer for handling large numbers of metal parts on racks, etc.

☆ ☆

Metal Saw

THIS new unit is attachable to any ¼-in. electric or air drill or flexible shafting. It chucks in a drill chuck or collet and saws or files metals, wood and plastics. Ordinary hack saw blades and standard ¼-in. shank machine files are used. The square plunger has a take-up for wear, and all rotating parts are heat-treated, ball-bearing and run in oil. WYZENBEEK & STAFF, 838 W. Hubbard St., Chicago 22.



Wyzenbeek "Hi-Speed" saw. It saws and files

Your best bet

for cast iron welding jobs

. . . WILSON ELECTRODE No. 97

Here's a rod that's especially designed for all-position welding of cast iron—where machineability of the deposit is not important. Made with a core wire of mild steel with an extruded coating, the Wilson No. 97 offers these notable features:

- A pink coating that acts as a flux . . . controls the arcing characteristics, permitting the use of low currents so desirable in cast iron welding.
- Smooth, uniform deposits of higher tensile strength than the cast iron.
- Light slag that is easily removed.

No. 97 is available in three popular sizes: 3/32", 1/8" and 5/32" diameters, 12", 14" and 14" lengths respectively. It is recommended for welding of cylinder blocks and heads, bearing blocks, machine parts, large frames and similar pieces. For best results, use reverse polarity with D. C. Alternating Current may also be used.

For full information about No. 97, and Wilson's complete line of electrodes, fill in the coupon and mail it today for a copy of Catalog ADW-75. Or, if you prefer, write your nearest Wilson distributor.

WE

WILSON WELDER & METALS CO., INC.

60 East 42nd Street
New York 17, N. Y.

Please send me a copy of Wilson Electrode Catalog ADW-75.

Name_____

Firm_____

Address_____

City_____ Zone____ State____

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WILSON WELDER and METALS CO., INC.

General Offices: 60 East 42nd Street, New York 17, N. Y.

Distributed by: A. M. CASTLE & COMPANY: Chicago, Seattle, Los Angeles, San Francisco; W. P. & R. S. MARS COMPANY: Duluth; KNIGHT & WALL COMPANY: Tampa; ARCOS CORPORATION: Philadelphia; THE CONGDON & CARPENTER COMPANY: Providence; J. M. TULL METAL & SUPPLY CO., INC.: Atlanta; H. BOKER & CO., INC.: New York, Cambridge, Mass.; GRAYBAR ELECTRIC CO., INC.: Pittsburgh, Cleveland, Cincinnati.

Represented Internationally by Airco Export Corporation

News of the Industry

Band Leader Turns Welding Manufacturer

FRANK Salenci, former band leader from Cleveland, known professionally as "Frankie Sullivan" has turned from music making to the welding business—with very good financial results.

Some ten months ago Frank received two welding machines in payment of $400 owed to him for an orchestral engagement. Instead of protesting the unusual compensation, he rented half of a garage and hired Vance Turner, a weldor, to work for him. The two men started to weld hand trucks. The small garage was soon vacated and 6,000 sq ft of space was rented to handle the fast growing business. Twelve additional employees were hired to assist in the manufacture of hand trucks and dollies. Frank, however, underestimated his speed of growth and once again had to move to larger quarters. This time he rented a three-story building and added 30 more employees, all ex-servicemen.

Salenci's latest venture is a new design for a hospital operating table that eliminates certain parts of the mechanism which he personally found annoying when he had to spend several weeks in a hospital. He hopes to turn out his new tables in quantity from welded steel. As soon as the welding business can carry on without him, however, he plans to organize another band and go back to his old love, the trumpet.

☆ ☆

Radio Salutes Welding Industry

"VALLEY FORGE RADIO CARAVAN," a nightly one-hour program sponsored by the Adam Sheidt Brewing Co., Norristown, Pa., paid tribute to the men and women who manufacture and use to good advantage the welding equipment of America. Among the hosts honored were B. J. Tesmer, treasurer, Burdett Oxygen Co., G. Van Allstyne, advertising manager, Air Reduction Sales Co., and W. W. Reddie, assistant manager, Westinghouse Electric Corp. From 1939 to 1945, it was brought out, the growth in this industry resulted in a 625% increase in the market.

☆ ☆

Germans Press-Weld Aircraft Radiators

"PRESS-WELDING" of aluminum sheets by German industry greatly accelerated the output of aircraft radiators, according to a report released by the Office of the Publication Board, Department of Commerce. The report was made by T. G. Haertel for the Joint Intelligence Objectives Agency, who suggests that press-welding of aluminum may have other applications than radiator manufacturing.

In the Adam Opel automobile factory near Frankfurt, sheets of spot-welded aluminum were virtually melted together between gas-heated dies closed under pressure. While the dies were nearly closed, compressed air was injected between the sheets to blow open areas between the welds. This was done to create passageways conforming to the design of the dies. The resultant pieces were then welded to produce aircraft radiators.

Orders for the report (PB-7742) should be addressed to the Office of the Publication Board, Department of Commerce, Washington 25, D. C., and should be accompanied by check or money order (photostat, $1; microfilm, 50c), payable to the Treasurer of the United States.

☆ ☆

W-AL-CO

WHITE METAL FILLER ROD

No. 716 LOW-MELTING ALUMINUM BRAZING ROD

ALUMINUM SOLDER

WELDING ALLOYS MANUFACTURING CO. 744 Broad St., Newark 2, N. J.

This announcement was written with molten steel on a stainless-steel letterhead

Lincoln Announces $200,000 Award Program

ANOTHER $200,000 in prizes will be distributed by the James F. Lincoln Welding Foundation as a means of encouraging further scientific progress in the arc-welding industry. There will be a total of 452 awards for technical papers covering every field of application and research for arc welding. These will range from $100 for honorable mention (217 awards) to the grand prize of $13,200 for the best of all papers.

The awards will be made in 15 broad classifications and 43 divisions of those classifications. Awards of $700, $500, $250 and $150 will go to the best papers in each of the 43 divisions.

In 11 of the 15 classifications, papers are called for on the redesign for arc welding of an existing machine, structure or fabricated product which was previously made in some other way. Another classification covers research work applied to arc welding by industrial, governmental, private and college laboratories. The same classification includes college engineering education having to do with improved methods for teaching arc welding.

The remaining three classifications call for papers describing the successful operation of all phases of a weldery; operations by commercial welders or job shops and garages; arc welding as applied to maintenance work on all types of machinery or structures.

The program closes at midnight June 1, 1947. Rules and conditions governing the activity may be obtained from the Foundation secretary, Cleveland 1.

☆ ☆

Next Metal Show Nov. 18 to 23

THE National Metal Congress and Exposition will be held again this year for five days beginning Nov. 18. This Metal Show, the 28th, will be staged in Atlantic City's municipal auditorium, marking the first time in five years that the event has been held in the east. It is estimated that more than 25,000 executives, engineers and production men will visit the exposition and attend technical sessions of the five participating societies.

Keep Eyes Safe From All 3

The application of the Bausch & Lomb Industrial Vision Service in your plant means: fewer accidents . . . increased production . . . improved quality . . . reduced labor turnover . . . lower training costs. Write for this booklet.

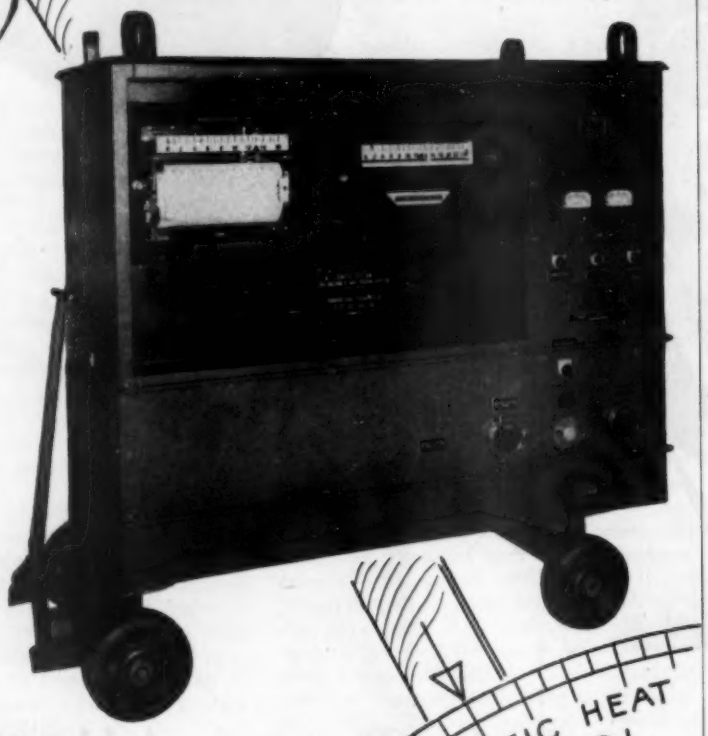
Bausch & Lomb Welding Glass provides complete protection from all 3 of the eye hazards encountered in electric and acetylene welding . . . blinding glare, and the invisible but harmful infra-red, and ultra-violet radiations.

In a complete range of densities, with transmission characteristics conforming to Federal Standard Color Specifications, Bausch & Lomb Welding Glass may be obtained in lenses for B&L Welding Goggles or in welding plates for use in helmets or hand shields. Write for complete details. Bausch & Lomb Optical Co., 754-6 St. Paul Street, Rochester 2, N. Y.

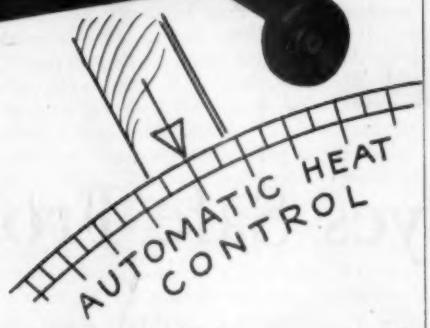
BAUSCH & LOMB

Safety Eyewear

WELDING
MODERN STEELS
BY
MODERN METHODS
DEMANDS
INDUCTION HEATING



60 KVA Model BH Induction Heater with Full Heat Cycle Program Control and 6 Point Recorder



FOR PRECISION
CONTROL OF
HEAT!

INDUCTION HEATING by the **SMITH DOLAN SYSTEM**
Plus The New **HEAT CYCLE PROGRAM CONTROL**
Gives all this and more.—Precision control of **PREHEATING FOR WELDING** and **NORMALIZING AFTER WELDING** is the only efficient method for joining modern alloy steels.

MODERN—SELF-OPERATING—COMPLETE!

Once the metallurgical heat-cycle for the steel has been determined, it is only necessary to set the controls, and the machine shown above will deliver this program from start to finish! In addition, recorded charts keep permanent records for duplication of results. A complete unit for efficient performance. Temperatures up to 1750° F. readily obtainable.

ELECTRIC ARC, Inc.

152-158 Jelliff Ave. **Newark 8, New Jersey**

Offer Royalty-Free Use of High-Temperature Steel

ALL patent rights of a "stabilized" steel of a carbon-molybdenum-chromium composition designed to meet the requirements of high-temperature steam lines in power plants and the chemical industry have been dedicated to public use on a royalty-free basis by U. S. Steel and Carnegie-Illinois Steel Corp. The use of the material was patented by Dr. Marcus A. Grossman, director of research, and Dr. R. F. Miller, development engineer, stainless and alloy steels, Carnegie-Illinois. The patent relates to "the use of a grade of steel particularly resistant to graphitization when subjected to stress in the temperature range from 800 to 1,100 F."

The steel embraced in the patent is a pearlitic, non-air-hardening type containing from 0.08 to 0.20% carbon, 0.45 to 0.65% molybdenum and 0.15 to 1% chromium.

☆ ☆

Welding No Fire Hazard, Insurance Study Shows

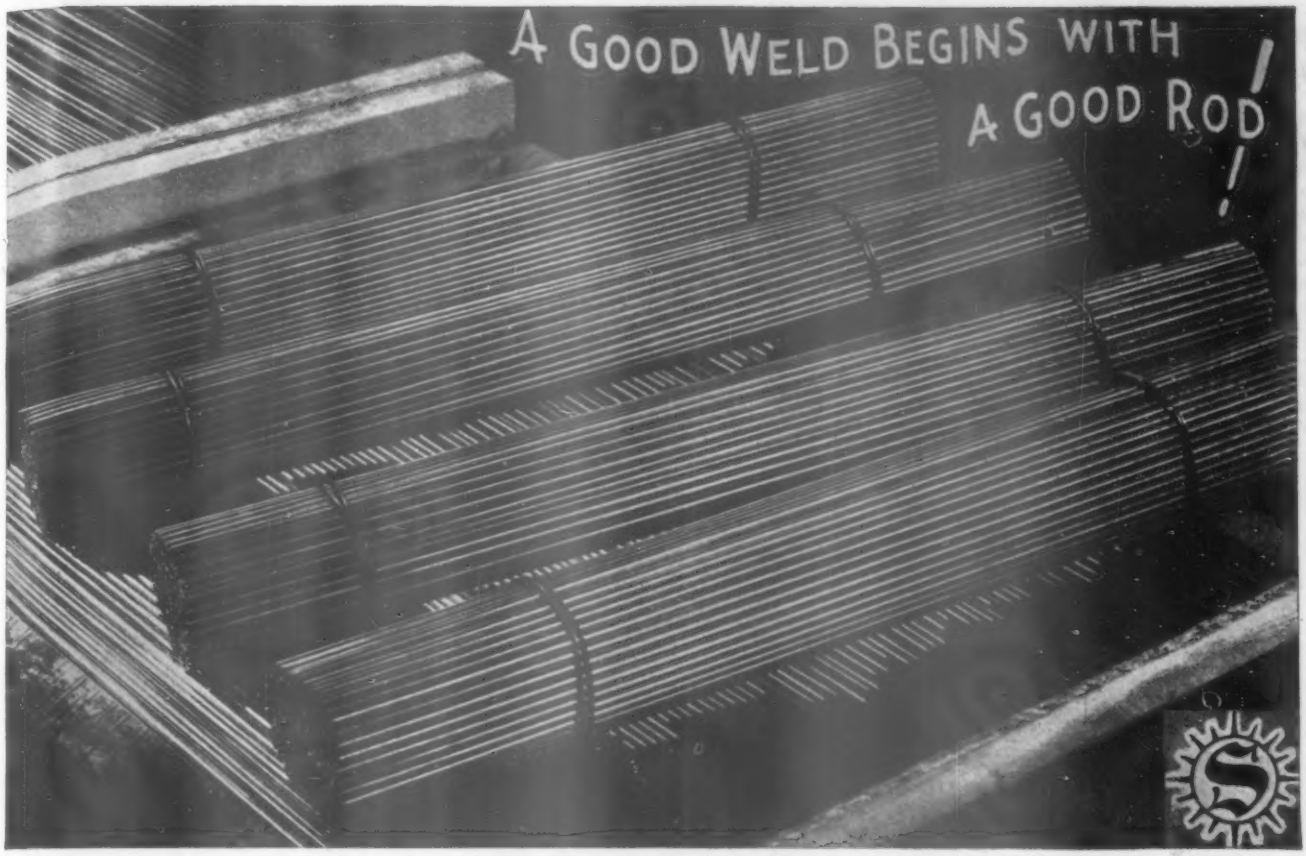
A RECENT study released by the National Fire Protection Association shows that out of 329 "large loss" fires only 12 or 3½% were caused by welding. Heating defects (15%), electrical causes (9%), flammable liquids (6%) and smoking (5%) were among the main reasons for fires. However, causes for 158 of these fires (48%) were unknown.

☆ ☆

New York AWS Section Inspects Metal & Thermit Laboratories

METAL & THERMIT CORP. recently conducted an inspection trip through its research laboratory at Woodbridge, N. J., for almost 200 members of the American Welding Society's New York section. The visit provided one of the first opportunities since the war to see first hand such wartime and postwar developments as underwater welding and cutting and thermit-welding applications.

The program included a new motion picture, "Mass Production of Massive Parts," and guided tours through the analytical, chemical and pilot plant divisions of the laboratory. Demonstrations of equipment and procedures were made at various points in the welding division. Of particular interest were the underwater demonstrations and the thermit reactions shown in connection with the welding of railroad rails and the production of steel castings. Metal & Thermit officials conducting the tour were John B. Tinnon, vice-president, and Dr. Lincoln T. Work, director of research. Charles Kandel of the Craftsweld Equipment Co., headed the AWS committee on arrangements. The specialists who explained the various demonstrations were: H. O. Klinke (stainless-steel welding), Air Reduction Sales Co.; E. Vom Steeg (all-position mild-steel welding), General Electric Co.; Lysle Wilson (downhand mild-steel welding), American Bureau of Shipping; R. C. Pearson (tensile and Navy bend tests), Brooklyn Navy Yard; H. R. Isenburger (X-ray inspection), St. John X-Ray Laboratories; C. D. Cooper (underwater welding and cutting), Metal & Thermit Corp. and J. H. Deppeler (thermit welding), Metal & Thermit.



Ready for those hard jobs!

SEYMOUR Phosphor Bronze Welding Rod quality is based on nearly 70 years of experience in the manufacture of bronzes and other nonferrous alloys. They melt easily and flow smoothly into crevices, producing ductile, homogeneous welds of high tensile strength.

The manufacture of these rods is a precision job. There is no guess work, and variables are held to a decided minimum. Casting is done in modern electric furnaces under accurate heat control, and a well-equipped laboratory tests every melt.

Seymour Phosphor Bronze Welding Rods, in Grades A, C and D, are obtainable through welding supplies jobbers everywhere.

SEYMOUR

PHOSPHOR BRONZE

WELDING RODS

THE SEYMOUR MANUFACTURING CO., SEYMOUR, CONN.

NONFERROUS ALLOYS SINCE 1878

Plan Program to Curb Japanese Industry

AT the request of the U. S. Departments of War and State, the National Engineers Committee of the Engineers Joint Council, representing five national engineering societies in the United States, is preparing a suggested program to eliminate the industrial war potential of Japan. The Committee's report embodies a suggested program based on engineering, industrial and economic factors.

The study is under the direction of Col. Carlton S. Proctor, Dr. Harry S. Rogers, president of the Brooklyn Polytechnic Institute, and Sidney D. Kirkpatrick, editor of McGraw-Hill Publications.

Wheel Company Installs New Flash Welder

IN order to give better service to its ring and flange customers, the King Fifth Wheel Co., Philadelphia, is installing new flash-welding equipment made by the National Electric Welding Machine Co., Bay City, Mich. The new welder has been designed to furnish selective heat control in small steps over its entire range in order to insure correct flashing for any specified section. The unit will handle stainless steels in sections up to 4 sq in. in cross-sectional area and nearly all other steels up to 8 sq in. In addition to rectangular pieces, King will bend and weld angles, channels, etc.

Arcos Corp. Opens New England Offices

A NEW district office at 450 Asylum Street, Hartford, Conn., has been opened by Arcos Corp., manufacturer of stainless and alloy electrodes. John K. Light will be the field engineer in charge, and he will be assisted by Charles B. Culbert. Both men are well informed on alloy welding problems, having served for a number of years in the Arcos Philadelphia office.

☆ ☆

New Firm Enters Welding Supply Field

BENT Laune, Dick Mandel and Tom Nast have formed their own welding distributing company, All-State Welding Supply Co., with headquarters at 96 W. Post Road, White Plains, N. Y. Mr. Laune is president; Mr. Mandel, vice-president and Mr. Nast, secretary and treasurer. Regional offices are located in Chicago and Los Angeles.

Operating on a national basis, the distributor will supply a complete line of brazing alloys and fluxes designed for use on cast iron, steel, aluminum, brass, copper and for the joining of dissimilar metals.

☆ ☆

Transportation Co. to Handle Railway Supplies, Electrodes

CHAMPION Transportation Sales, Inc., Chicago, has been formed to handle the sales of railway supplies on a national basis. The company will represent the Champion Rivet Co., maker of a complete line of electrodes, and the Aeronautical Products, Inc., and Econite, Inc. Offices are located at 6 So. Clinton Street, Chicago 6.

☆ ☆

Sciaky Incorporates

SCIAKY Bros., resistance-welder manufacturer at 4915 W. 67th St., Chicago, has incorporated to facilitate business transactions. The corporation assumes contractual obligations and liabilities of the former partnership. No changes have been made in management or personnel.

☆ ☆

$2,000 RWMA Contest Closes July 31

THE $2,000 contest for the best paper on the design, application and research of resistance-welding conducted by the Resistance-Welder Manufacturers' Association will close midnight, July 31, 1946. Five prizes are being offered (see page 88, February, 1946 issue, THE WELDING ENGINEER).

☆ ☆

St. John X-Ray Moves

ST. JOHN X-RAY LABORATORY, INC., has moved to its own building located at Califon, N. J.

Built for Better Service

INVESTIGATE DOCKSON'S COMPLETE LINE OF HEAD & EYE PROTECTION

Like all Dockson Products the 60 and 70 series goggles shown above are the result of Dockson's long experience and "know-how".

The 60-08 is a popular, general purpose, molded monolite goggle, especially equipped for chipping and grinding jobs while the 66-18-5 is the same goggle equipped for welding use.

The 70-08 is a cover spectacle chippers and grinders goggle for use over prescription glasses and it's one of the finest molded designs made.

The 76-18-5 is the welder's version of this same style. Both have the new easy adjusting brace bar and many exclusive Dockson features. There is no price penalty for Dockson Superiority.

DOCKSON CORPORATION
3839 Wabash • Detroit 8, Mich.

"Very satisfactory -- cut faster and lasted longer than wheel of other make."

"Best wheel we ever used -- reordering."

"Best wheel we ever had. Equal life and much better cutting action than competing wheel."

"Life about double that of wheel we have been using. Finish and cutting action good."

"Cuts faster and produces smoother finish than competing wheel."

Here's what they say about the NORTON *B-5 RESINOID* WHEEL

THESE quotations are from actual trial reports of the performance of the new Norton B-5 resinoid wheel *on weld grinding jobs.* They cover both straight wheels and cup shapes and are typical of experiences everywhere with B-5 wheels.

If you are not already using the Norton B-5 wheel it will pay you to try it at once. Get in touch with your Norton abrasive engineer or Norton distributor for specific recommendations for your jobs.

NORTON COMPANY, WORCESTER 6, MASS.

Distributors in All Principal Cities

W-1055

NORTON ABRASIVES

Linde to Expand Oxy-Acetylene Facilities

THE Linde Air Products Co. has started construction on two new oxygen filling stations and acetylene producing plants at Evansville, Ind., and another on West Trade Street, Charlotte, N. C. The new plants are expected to be in operation by the first of June.

☆ ☆

Ampco Forms New Division

AMPCO METAL, INC., 1745 So. Thirty-Eighth Street, Milwaukee 4, has formed a process industry division which will handle inquiries and engineering problems in this field. Engineering specialists have been assigned to give advice on the best engineering practices involving corrosion-resistant bronze alloys.

☆ ☆

NWSA Adopts New Plans

WELDING equipment and supply distributors attending the second annual convention of the National Welding Supply Association at Dayton, O., April 29 and 30 elected L. O. Schneiderwind, Omaha, president; Ralph E. Chase, Benton, Ill., senior vice-president, and H. G. Weiler, Dayton, secretary-treasurer. Ten trustees for one and three year terms were also elected.

Departing from a heretofore strictly distributor organization, NWSA members approved changes in their constitution to make manufacturers of welding equipment, supplies and/or gases eligible for membership. A resolution was also adopted to the effect that NWSA will not foster or encourage coöperative purchasing or selling.

☆ ☆

German Patents Offered on Stainless Tubing

THE office of Alien Property Custodian recently announced that fourteen U. S. Patents on the manufacture of stainless steel tubes seized from enemy nationals are available for licensing to American citizens and industry. These inventions are the result of work of enemy technicians in the Dusseldorf area, the heart of the German steel industry. Licenses are available on a royalty-free, non-exclusive basis for the remaining life of the patent.

☆ ☆

Chicago Welding Firm Incorporates

JENSEN Welding Equipment Co., Inc., is the new name of the former Jensen Welding Equipment Repair Co. The firm will continue to operate at 2436 N. Cicero Ave., Chicago. The corporation will take over all of the assets of the former partnership.

There have been no changes in personnel or management. Jerrold L. Jensen will serve as president, and Richard J. Jensen as vice-president of the newly incorporated firm.

☆ ☆

Tags "Nailed" to Cold Ingots

EMPLOYEES at the South Chicago Works of Carnegie-Illinois Steel Corp. soon will be doing the seemingly impossible; *i.e.*, nailing identification tags to cold ingots of hard steel with very little effort. A 2¾ lb hammer with a simple spring attachment to hold the specially heat-treated, quarter-inch nail and metal tag bearing the heat number is all that is required.

☆ ☆

New Distributors

THE Champion Rivet Co., Cleveland 5: (distributors of welding electrodes) F. J. Sweeney, Cleveland and Akron district; Terminal Engineering & Supply Co., 47 Terminal Way, Pittsburgh; Norton Welding Equipment Co., 444 No. 29th Street, Milwaukee.

☆ ☆

INDUSTRIAL Overlay Metals, Inc., Chicago 4: (distributors for hard-facing electrodes) Gulf Battery & Distributing Co., Houston, with branches in Austin, San Antonio, Corpus Christi and Beaumont, Tex.; Brown Auto Supply Co., Decatur, Ill.; Welding Supplies, Inc., Macon, Ga.; O.K. & I Welding Supply Co., Cincinnati.

Typical cast iron gear with broken tooth which will be rebuilt by welding.

Same gear after making quick, dependable repair with MARQUETTE NICOL-ROD 44.

● The Original and Best Nickel Rod! This outstanding Marquette A.C.-D.C. Rod is a copper-nickel alloy with a special coating which gives excellent welding characteristics. Makes perfect bond to parent metal and leaves a soft, sound, close grained . . . and *Machineable* weld on all types of cast iron *without* pre-heating. Thoroughly machineable . . . you can easily drill or mill it. There is a complete absence of porosity, slag inclusion or hard spots and it matches the parent metal perfectly.

Marquette A.C.-D.C. Nicol-Rod 44 is low in cost, but worth its weight in gold! . . . for years, shops and foundries have used it for salvaging expensive castings which otherwise would be rejected because of sand pockets or blow holes. It is truly a money saver in maintenance and production for repairing castings inexpensively.

NOTE: Marquette A.C.-D.C Nicol-Rod 44 is safe to use. There are no injurious fluoride fumes to harm the eyes, nose or throat.

LOOK TO MARQUETTE FOR LEADERSHIP

MARQUETTE WELDING EQUIPMENT SOLD EXCLUSIVELY THRU THE NATION'S LEADING DISTRIBUTORS

MARQUETTE
REGISTERED U.S. PAT. OFFICE

Welding EQUIPMENT

A.C. ARC WELDERS · ELECTRODES
GAS WELDING and CUTTING EQUIPMENT
ACETYLENE GENERATORS · ACCESSORIES

MARQUETTE MFG. CO. INC.
MINNEAPOLIS 14, MINN.

THERMIT WELDING

FOR QUICK, ECONOMICAL AND DEPENDABLE REPAIRS

Thermit welding saves valuable time and makes possible new economies by putting broken and worn equipment back into operation quickly and efficiently.

An example of the repair service and all around usefulness of the Thermit process is the welding of a new wabbler end to the neck of this large steel mill pinion. In another typical case a mill reported welding new ends on three spindles. To replace the spindles would have cost $5,842.00, whereas to salvage them with Thermit cost only $1,181.00. A saving of $4,661.00!

The chief advantages of the Thermit process for the repair of such heavy parts are the great strength and durability of the weld, and the fact that preliminary machining and subsequent stress relieving are not required. Moreover, there is no limit to the size of the weld—nor does it matter whether the part is cast or forged.

In addition, Thermit welding is used for the fabrication of large units from smaller castings or forgings. This minimizes shipping and handling problems, and eliminates the risk of having to remake very large castings. For complete information, send for a copy of "Thermit Welding" or consult Metal and Thermit Corporation, 120 Broadway, New York 5, N. Y., Albany, Chicago, Pittsburgh, So. San Francisco, Toronto.

THERMIT WELDING

About People

WILLIAM A. SCHEUCH, former vice-president of Nassau Smelting and Refining Co., subsidiary of Western Electric Co., has been elected president. He succeeds FREDERIC W. WILLARD, who has retired after 40 years of service in the Bell System. GEORGE J. BOILEAU, treasurer, has been elected vice-president and will succeed Mr. Willard on the board of directors. E. F. BAXTER has been elected treasurer and E. F. STOKER, assistant treasurer.

☆ ☆

TORSTEN F. A. EDVAR, formerly of the Harold E. Trent Co., has been appointed to the engineering staff of the Ajax Electric Co., Philadelphia.

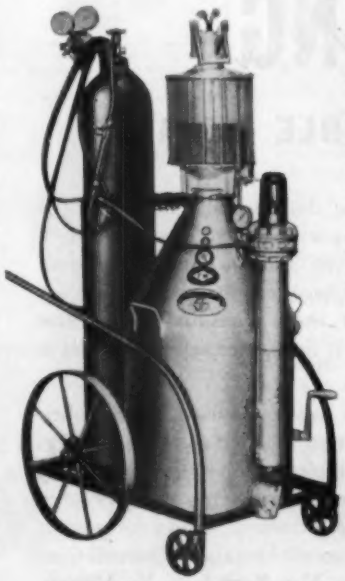
☆ ☆

WALTER R. FIDELIUS, formerly superintendent of the tank hall dept. of the Fitzgibbons Boiler Co., Inc., has been appointed assistant chief engineer of the Optimus Equipment Co., Matawan, N. J.

"WILL I HAVE ENOUGH ACETYLENE FOR TOMORROW'S JOBS?"

You will—if you have a Sight Feed Generator

● You won't run out of acetylene if you have a Sight Feed Acetylene Generator. A glance at the hopper will tell you instantly how much acetylene you have available.



As a user of acetylene you know it is wasteful of both time and money to change cylinders or recharge a generator in the middle of a welding or cutting operation. Sight Feed's hopper eliminates this loss. Look at the hopper, it is Pyrex, you look through it, not into it. The carbide is always visible.

A Sight Feed saves 50% to 75% on acetylene costs.

Stop at your jobber's store and have him demonstrate the Sight Feed or write for free 16-page catalogue No. 44-G.

ACETYLENE GENERATORS • FLOODLIGHTS • FLARELIGHTS

ACETYLENE Sight Feed GENERATORS

THE SIGHT FEED GENERATOR COMPANY

RICHMOND, INDIANA

ROY A. EGELOFF has been named sales representative of Titan Metal Mfg. Co., Bellefonte, Pa., manufacturer of brass and bronze rods. He will cover Iowa, Kansas, Missouri, Southern Illinois and Southwestern Indiana, with offices at 817 Arcade Building, St. Louis.

☆ ☆

BENJAMIN O'SHEA has retired as chairman of the board of directors of Union Carbide and Carbon Corp. He will continue as a director and a member of the executive committee. The office of chairman of the board has been abolished with Mr. O'Shea's retirement.

☆ ☆

TOM J. PETERS has been appointed division superintendent of maintenance at the South Chicago plant of Carnegie-Illinois Steel Corp. He succeeds JOHN S. TOWNSEND, who has retired.

☆ ☆

I. H. MITCHELL, formerly associated with the Crosley Corp., Cincinnati, has been appointed advertising manager and public relations director of the Eutectic Welding Alloys Corp. Mr. Mitchell brings to his new position an experience of over twenty years in the advertising field.

☆ ☆

RICHARD F. GARRETSON has been appointed eastern regional manager of the industrial division for Ransome Machinery Co., a subsidiary of Worthington Pump and Machinery Corp. He is in charge of sales of welding and work-positioning equipment with offices at 2905 N. Broad Street, Philadelphia.

☆ ☆

JAMES H. WITHERS has been named district manager in charge of the San Francisco and Los Angeles offices of Tube Turns, Inc. S. M. (SKID) SPEARS, JR., has been promoted assistant district manager of the firm's New York office.

☆ ☆

W. S. CHAPMAN has returned to the California district of the Taylor-Winfield Corp. as factory representative. Mr. Chapman has a broad experience in the application and service engineering of resistance-welding equipment.

☆ ☆

STANLEY D. MEANS has been appointed to the newly-created position of domestic sales manager for R. G. LeTourneau Inc., Peoria, Ill. Mr. Means will have charge of all company sales in the United States, Canada, Hawaii and Alaska.

☆ ☆

C. C. MCDERMOND has been appointed representative of the welding fittings division of Tube Turns, Inc., in Venezuela and Colombia, South America. C. T. MCCOY, field engineer, will be Mr. McDermond's assistant. They will make their headquarters in Apartado No. 331, Maracaibo, Venezuela.

GEORGE A. KELLY, vice-president of The Pullman Company in charge of public relations and advertising, has been elected executive vice-president of the company. As director of advertising and public relations, Mr. Kelly has played an important role in the promotion of rail-Pullman travel. He succeeds CHAMP CARRY, who resigned to become president of the Pullman-Standard Car Mfg. Co., subsidiary of Pullman Inc.

☆ ☆

ALBERT J. BROWNING, formerly group merchandising manager for Montgomery Ward and Co., has been appointed director of purchases for the Ford Motor Co.

RUSSEL P. WOOD has been promoted manager of the company's Twin City branch in St. Paul. He succeeds M. N. JOHNSON, resigned. FREMONT W. MITCHELL will be assistant manager of the branch.

☆ ☆

FOUR new vice-presidents have been elected at the Ford Motor Co. They are: HERMAN L. MOEKLE, finance, formerly secretary; JOHN R. DAVIS, sales and advertising; JOHN S. BUGAS, industrial relations, and ALBERT J. BROWNING, purchasing.

☆ ☆

FRED W. HERMAN, chief engineer of Douglas Aircraft Company's Long Beach plant, has been appointed plant manager. He succeeds A. C. WALLEN, who was transferred to the company's Santa Monica plant as production manager.

☆ ☆

DOUGLAS C. OGILVIE, formerly welding consultant for Charles W. Krieg Co., Newark, has been appointed manager of the Gasflux Co., Mansfield, O. His headquarter will be at 487 Orange Street, Newark 7.

☆ ☆

HOMER W. NORTHRUP, formerly with the melting department of the iron and steel foundry division of the Crane Co., Chicago, has joined the Chicago technical section of the International Nickel Co., Inc.

☆ ☆

D. R. PETERSON, son of the late Roy Peterson, has been appointed president of Peterson Welding Laboratories, Kansas City, Mo. Mr. Peterson has been associated with the laboratories for the past ten years and general manager for the past year.

☆ ☆

J. H. PENCILLY, vice-president of Square D Co. recently released from wartime service, has been appointed general manager of the company's west coast division.

☆ ☆

JOHN F. CONROY, III, discharged after serving 44 months in the U. S. Coast Guard, has resumed his position as president of National Magnesium Corp., Md.

WILLIAM G. HALL has been made manager of a combined renewal parts and service division for The Reliance Electric & Engineering Co., Cleveland. Mr. Hall succeeds ARTHUR W. RAY, who has retired after completing 40 years with Reliance.

☆ ☆

CARL A. TEN HOOPEN has been appointed eastern district sales manager of the Cyclone Central division of American Steel & Wire Co. He succeeds S. W. BURR, who will handle special sales assignments for the company. THOMAS S. HUMRICKHOUSE succeeds Mr. Ten Hoopen as manager of the Cleveland district. E. B. WILHELM has been named manager of a separate sales district for Michigan with headquarters in Detroit.

☆ ☆

Died . . .

ROY A. PETERSON, founder of the Peterson Welding Laboratories, Kansas City, Mo., died April 8 after a long illness. He began manufacturing welding and brazing fluxes 20 years ago, experimenting and perfecting his four "fluxes of merit." Mr. Peterson also patented a procedure to weld cylinder heads and blocks and large heavy castings. He was well known for his ability and knowledge of welding and brazing cast iron and had held many instruction clinics to teach his procedures to weldors throughout the middle west.

SAVE TIME USE A
CMD
WELDERS CHIPPING HAMMER
With steel or wooden handle. Light weight. Strong. Easy to use. Write for circular.
TYPES EB and FB
Models E and F can be supplied with brush as shown here. Brush can be replaced by unscrewing countersunk screw in bracket and removing.
TYPE F
Head has two chisels at right angles.
TYPE E
Head has drift and chisel.
TYPE A
Has drift and chisel. Widely used in malleable and grey iron foundries for general chipping.
TYPE CB
Combines 3 tools in 1—drift, chisel and removable wire brush.
TYPE C
Same as Type CB, but without brush.
CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS

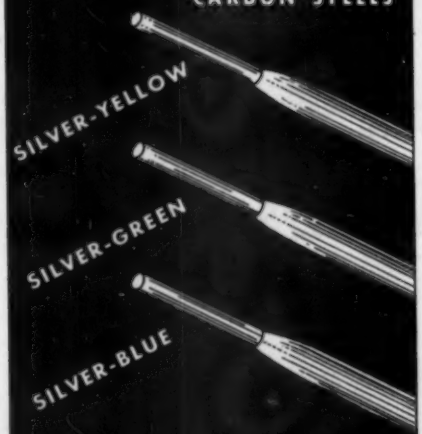
AGILE

Silver Series

ELECTRODES

FOR APPLICATION TO

HIGH CHROMIUM AND HIGH CARBON STEELS



Write for Free CATALOG TODAY!

SILVER-YELLOW deposits a weld metal that can be hardened in oil or air to give sufficient wear resistance and is non-deforming under heat treatment. Weld metal hardness 50 to 53 Rockwell C.

SILVER-GREEN deposits a weld metal of extreme toughness, excellent shock resistance and gives long life cutting edges. Recommended for forming tools for building dies with soft and medium carbon steel base and for hard facing worn tools. Weld metal has hardness of 48 to 52 Rockwell C.

SILVER-BLUE gives an excellent deposit that can be hardened in oil and water. Rockwell C 62 to 65. Recommended for welding applications requiring hardness, wear and shock resistance. Write for free catalog today!

AMERICAN AGILE CORPORATION

5806 HOUGH AVENUE

CLEVELAND 3, OHIO

Helpful Literature Just Published

Unless otherwise stated, the publications reviewed in this section may be obtained without cost by writing to the manufacturers listed.

Copper Alloy Handbook

A NEW 32-page handbook gives extremely useful information on the welding and brazing of copper and copper alloys. The first part lists the properties of various copper alloys and gives a full-page chart of recommended rods and welding practices for difficult base materials. Joint design, preparation of materials, jigs and fixtures are also covered.

The second section gives welding and brazing procedures for 12 copper and alloy groups, including phosphorus deoxidized copper, phosphor bronze, silicon bronze, other bronzes, Muntz metal, Naval brass, manganese bronze, low brass, red brass (rich low brass), commercial bronze, bronze castings (repair and salvage). Brazing with low-melting-point alloys is also covered.

The book concludes with a section on the various electrodes or rods available for welding the base materials mentioned above. Under each of 13 rod types is given its general purpose, application, procedure and specifications. C. E. PHILLIPS & CO., INC., 2750 Poplar Street, Detroit 8.

☆ ☆

"Build Your Own Welder"

"HOW to Build Your Own Gas Drive Welder" is the title of a new 48-page, 5½ by 8 in. book that takes its reader through progressive step-by-step plans for building at least part of his own equipment. Given the basic essentials of a welding generator, a gasoline engine, a frame for mounting the preceding two units, a radiator, a fuel tank and a canopy top, any man with average mechanical ability can assemble and build these parts into an engine-driven welder that will give years of service, the text points out. Particular attention is given to the building of units for farm use. The reading material is amply supplemented by photographic reproductions and sketches showing the necessary details of construction. Ask for EW-113, HOBART BROTHERS CO., Hobart Square, Troy, O.

☆ ☆

Tweco Catalog

A 12-PAGE booklet published by Tweco Products Co. is devoted to electrode holders, ground clamps and cable connectors. The initial section of the text gives details of the new "Twecotong" insulated and semi-insulated electrode holders. These holders have interchangeable top and bottom jaw and body insulators made from molded-laminated woven glass cloth Bakelite. The second section lists the company's other electrode holders, their sizes, weight, amperage capacities and prices.

A third section gives specific information on "Redhead" ground clamps, and this is followed by a summary of "Sol-Con" and "Mec-Con" cable connectors. The catalog concludes with information on mechanical solderless lugs, Tweco miscellaneous products and cable splicers of high-copper alloy. TWECO PRODUCTS CO., English at Ida, Wichita 7, Kansas.

☆ ☆

Mycalex Booklet

A NEW 24-page booklet explains G-E "mycalex," a stonelike insulating product composed of mica and a special glass. Mycalex is used for molded parts demanding stability at high-operating temperatures, resistance to changing atmospheric conditions, inherently high arc resistance, high electrical and mechanical strength and low dielectric power loss. A unique characteristic, the text explains, is that metal parts can be inserted or combined with mycalex during the process of molding. CHEMICAL DEPARTMENT, GENERAL ELECTRIC CO., Pittsfield, Mass.

☆ ☆

Industrial Safety Charts

A SERIES of six industrial safety charts has been published by the U. S. Department of Labor to promote greater safety precautions by plant and factory workers. Interesting pictures illustrate the "dos and don'ts" every machine operator should keep in mind while at his work. Copies of this series "M" may be obtained at 5c each from the SUPERINTENDENT OF DOCUMENTS, U. S. GOVERNMENT PRINTING OFFICE, Washington 25, D.C.

☆ ☆

Electrode Comparison Chart

A FOUR-PAGE chart to help in selecting the correct welding rod or electrode for a specific application lists 14 Amsco welding rods and their proper uses. The applications listed are: strength welds, build-up welds, abrasion with severe impact, severe abrasion with medium or mild impact, abrasion with medium impact, abrasion with shattering impact, composite tools, dies, jigs, etc., agricultural implement repairs, red-hardness, abrasion and corrosion, tungsten carbide fines and tungsten carbide particles. Ask for Bulletin CC-2, AMERICAN MANGANESE STEEL DIVISION of AMERICAN BRAKE SHOE CO., Chicago Heights, Ill.

☆ ☆

Steel Rings Booklet

THE production of rings from steel plate by bending rolls, circle shears, flame-cutting, spinning, blanking, rim presses and many other methods is detailed in a new 12-page booklet from Lukens. Full rings, half rings or segments may be formed, and the rings may be either seamless, welded or left unwelded. Tacking, automatic-welding and flash-welding methods are described and pictured. LUKENS STEEL CO., 282 Lukens Bldg., Coatesville, Pa.

Precious Metals Booklet

A FOUR-PAGE, three-color folder describes the various uses of the "precious metals"—gold, silver, platinum, palladium, ruthenium, rhodium and osmium—for science, industry and the arts. Among the desirable qualities of these metals are resistance to oxidation, acid attack, corrosion, high temperatures; hardness and electrical conductivity. Silver is, of course, a case of special interest to the readers of this publication. Silver-brazing alloys produced in strip, coiled wire, rings, washers and special shapes and flux pastes for silver brazing are described in the pamphlet. AMERICAN PLATINUM WORKS, 231 New Jersey Railroad Ave., Newark 5.

☆ ☆

Hard-Facing Data Sheets

A SERIES of four engineering data sheets gives useful information on Wall-Colmonoy hard-facing alloys. No. 1 in the series, a coverage table for ten types of Colmonoy products, gives the coverage in square inches per pound of alloy and the pounds of alloy required to overlay 1 square foot of surface for overlay thicknesses of 3/32, 1/16, 3/32 and 1/8 in.

Abrasive resistance of overlays is covered in a second sheet. The standard used is steel of Rockwell C 65 hardness, taken as 100, and the test machine is a tabor abraser with steel wheels, using wet abrasives. One table gives the results secured by testing each alloy with three different abrasives and also an average of the three readings. The second table compares the abrasive resistance of Colmonoy alloys to that of cast iron and mild steel.

The third data sheet, summarizing the results of corrosion tests on nickel alloys and other metals, includes six Colmonoy alloys, cast iron, mild steel, Nichrome and stainless steel. The calculations are based on loss in weight for a given area and upon the density of the material tested.

Specific information on the hard-facing of roll-crusher teeth is listed on the last data sheet. This gives a detailed procedure for building up the worn tooth with a nickel-manganese electrode and then overlaying the top and front with a hard-facing alloy. WALL-COLMONOY CORP., 720 Fisher Bldg., Detroit 2.

☆ ☆

Stainless Electrode Chart

A LARGE-SIZED data sheet folding into an 8¼ by 11 in. cover has been recently published by ARCOS CORP., 312 Gulf Bldg., Philadelphia. This "electrode correlation chart" lists every well-known stainless steel by trade name and gives the proper Arcos alloy electrode for welding each. AISI type numbers and analyses of the various stainless steels are also given as well as the weld-metal analyses of the electrodes used to weld them.

☆ ☆

Stress Analysis Pamphlet

AN eight-page 5¾ by 8½ in. folder surveying the general aspects of photoelastic stress analysis has been compiled for the benefit of engineers and scientific investigators. Sketches illustrate the optical theory and detail the layout of the polariscope for photographing the patterns. Copies of "Photoelastic Stress Analysis" may be obtained by writing EASTMAN KODAK CO., SALES SERVICE DIVISION, Rochester 4.

☆ ☆

Anniversary Booklet

THE PROGRESSIVE WELDER CO., 3050 E. Outer Drive, Detroit 12, has published an eight-page booklet "It Pays to Weld" telling the story of its growth and advances in the resistance-welding field. Also described is a flash welder of universal design, a special seam welder that makes two parallel welds and another pair of welds at any angle and a fast-operating press-type spot welder capable of up to 150 spots per minute.

☆ ☆

Safety Tool Catalog

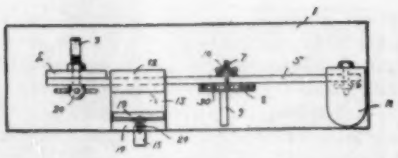
A 28-PAGE catalog (No. 117) lists over 500 safety tools made of non-sparking aluminum-bronze and beryllium-copper alloys. These tools are recommended for use in the presence of explosive liquids, fumes, gases, etc. AMPCO METAL, INC., 1745 So. Thirty-Eighth Street, Milwaukee 4.

EITHEREND
Cable Connector
CAT.4472
CAT.4472
For simple cable connectors that are unequalled in the welding connector field use ANDERSON EITHEREND. Eitherends are neither male nor female . . . no need to hunt for mating ends.
Fabricated of specially tempered admiralty tubing.
Consider these advantages.
Large Surface, Wiping-Action Contact.
Efficient, POSITIVE Connection.
Resilient, Self-Cleaning Contacts Never Need Dressing.
Built To Take Constant Hard Usage.
Strong, Durable Connections.
Economical — No Need To Throw Away Damaged Cable or Short Ends — Splice them with EITHEREND.
Available, when specified, with full protecting insulating sleeves.
Available with or without locking hooks.
Write for detailed information on the Eitherend . . . and other dependable welding equipment.
ALBERT & J. M. ANDERSON MFG. CO.
305 A STREET
BOSTON 10, MASS.

From the Patent Office

Protractor Welding Jig

2,396,452. William Widmark, Duluth, Minn., and Albert H. Brownlee, Superior, Wis. Filed Oct. 15, 1943. Issued March 12, 1946.

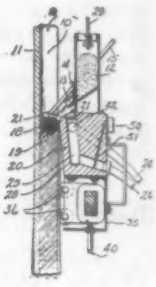


A welding jig comprising a base, an upright support and a normally horizontal work-guiding arm. The latter arm is vertically swingable and is pivotally carried upon the upright support. An adjustable work-holding member is slidable upon the base and coacts with the guiding arm. A circular protractor is pivotally supported by and adjustable longitudinally of the guiding arm. A guiding blade is fixed to the protractor to provide angular guidance of work to be attached at various predetermined angles to other work held within the work-holding member.

☆ ☆

Automatic Welding Method

2,395,723. Erwin A. Chmielewski, Milwaukee. Filed July 20, 1942. Issued Feb. 26, 1946.



An automatic-welding method comprising the approximately continuous advance of a highly heat-conductive metal block spanning the space between the parts to be welded. A continuous deposit of molten weld metal and flux in the space between the parts is made at a sufficiently high temperature so that the weld metal rejects the slag and lies in a slag-covered puddle. The chill block absorbs sufficient heat from the slag to cause it to congeal at the surface of the puddle. The block is removed from contact with the congealed slag as soon as it has formed a skin strong enough to retain the molten puddle behind it. The congealing of the molten metal then proceeds normally without further loss of heat to the block.

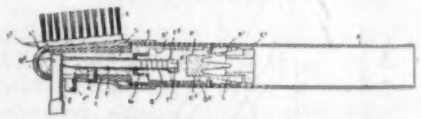
☆ ☆

Magnesium Flux

2,396,604. Hans A. Reimers, Midland, Mich., assigned to The Dow Chemical Co., Midland. Filed Nov. 21, 1942. Issued March 12, 1946.

A flux for use in welding magnesium-base alloys. It consists of a mixture of calcium chloride, potassium chloride and sodium chloride. Approximate percentages by weight are: calcium chloride 25 to 50%, potassium chloride 20 to 65% and sodium chloride 5 to 40%. The mixture has a melting point below 600 C. The flux also contains a fluoride of a metal selected from the class consisting of sodium, potassium, magnesium, calcium, barium, aluminum, beryllium, and strontium in a proportion representing between about 2 and 6% by weight of the total composition. The flux is substantially free of heavy metal salts.

☆ ☆



Electrode Holder

2,395,214. Philip L. Bourque, Detroit. Filed Feb. 7, 1944. Issued Feb. 19, 1946.

This patent pertains to an electrode holder handle formed of dielectric material, an electrode-clamping means projecting outward, a casing of dielectric material surrounding the projecting portion and a metallic casing surrounding the dielectric material. The dielectric casing is cut away for the passage of the electrode, and a pin of insulator material couples the metal casing with the electrode-clamping means.

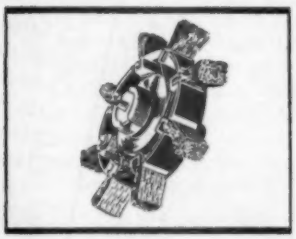
New Brush-Backed, Strip-Fed Abrasive Wheel Deburrs, Sands Any Surface!

For sanding in and around the most irregular contours—for deburring parts too large to be tumbled—for removing rust, paint and imperfections from wood, plastics, rubber, earthenware and metals—the new Sand-O-Flex brush-backed abrasive wheel is MOST PRACTICAL.

The central magazine houses a strip abrasive cartridge, to be fed out as needed in front of the eight brushes which "cushion" the abrasive, and force it evenly over the most difficult surfaces. The Sand-O-Flex comes in 3 sizes, and is adaptable to any stationary or portable motor shaft, with speeds up to 1750 RPM. Abrasives are available in grits for every need.

To help speed production in dry, dusty work atmosphere, many mills and factories urge workers to chew gum to help relieve dry throat. *The reason:* Because dust causes throat irritation and dryness—but chewing Wrigley's Spearmint gum helps keep workers' mouths moist and fresh. *The result:* Reduced work interruptions and "time outs" to the drinking fountain. Even when workers' hands are busy, they can refresh as they work "on the job." And the chewing action helps keep workers alert and wide-awake.

You can get complete information from the Sand-O-Flex Corporation, 4373 Melrose Ave., Los Angeles 27, California



Abrasive Cartridge Shown Open

AA-73

For Maneuverability Ya Gotta Have BALANCE!

Columbian Metal Craftsmen, Auburn, N. Y., needed a positioner that would allow many quick changes of position in the welding of their "Featherlite" aluminum furniture. Bentley BALANCED positioning solved the problem.

Operator shifts many-angled work wherever desired, without putting down welding torch or rod. A Bentley "boxes the compass" easily by hand. Model No. 1½-BMO has capacity of 150 lbs. A universal tool . . . for welding, assembly, maintenance and repair shops. Try a Bentley for maneuverability!

Bentley Weldery, Inc. 213 Riegel St. Syracuse, N. Y.

---

2 new GREYHOUND

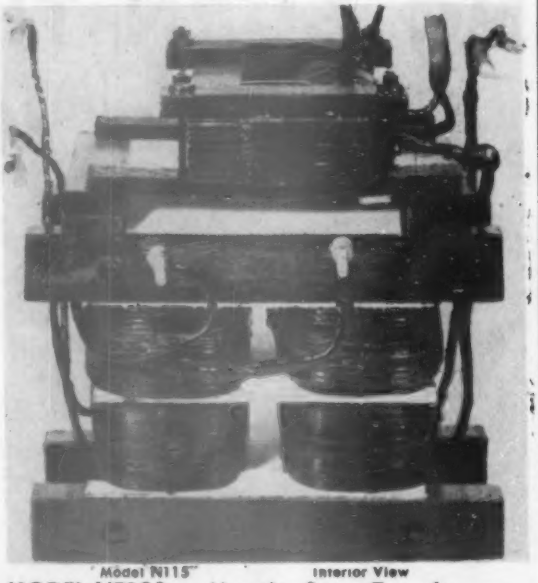
FARM and SERVICE STATION PORTABLE A. C. WELDERS

Built-in Capacitor for High Power Factor Correction — Meets R.E.A. Requirements — Also Reduces Power Bills and Installation Costs

Model N115 Exterior View

☆ ☆

Model N115—Has a New Power Packed Multiple-Coil Transformer, Features 4 Coils Instead of 2. Also Separate Reactance, Double-Woven Spun-Glass Insulated Magnet Wire. 15 to 115 Amperes.



Model N115 Interior View

MODEL NF180 — Has the Same Transformer as our World Famous Variable Core Type Heavy-Duty Industrial Models with Handwheel Stepless Amperage Control. Double-Woven Spun-Glass Insulated Magnet Wire. 20 to 180 Amperes.

Write for Details — **ALSO HEAVY-DUTY INDUSTRIAL MODELS**
Territories Available for Distributors

GREYHOUND A. C. ARC WELDER CORP.
Manufacturers
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STOP THEM with a BADGER Permanent Filter

In a year's time or less BADGER Filters may pay for themselves in your plant, too. By avoiding "down-time" stoppages due to damage of welder parts by process and atmospheric dust, they'll save production-time losses, man-hour losses, repair time and expense. One manufacturer saved up to 160 man-hours alone on every welder unit on which a BADGER Permanent Filter was installed.

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B·B·B Stands for Quality ... KEEN-ARC CARBONS

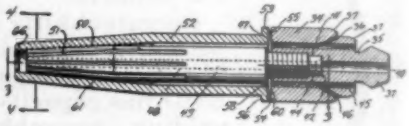
BECKER BROTHERS CARBON CO. 3450 So. 52nd Ave. Cicero 50, Ill.

Resistance-Welding Control

2,395,849. CLETUS J. COLLOM and GUSTAV E. UNDY, Detroit, assigned by Undy to Cletus J. Collom, an individual doing business as the WELTRONIC CO., Detroit. Filed Aug. 7, 1943. Issued March 5, 1946.

An electronic system for controlling the flow of current between a work circuit and a source of periodic current. It includes an electronic tube means for controlling the flow, control means for actuating the tube, means to enable the flow during the succession of cycles of current, means for causing the portions of the cycles throughout which flow occurs to vary in accordance with a predetermined pattern, an energy-storage device and circuit connections for providing control circuits through which the said device may be charged and discharged. The number of cycles is progressively increased when one of the control circuits is effective and progressively decreased when the other control circuit is effective.

☆ ☆



Bevel Cutting Tip

2,397,349. FLOYD I. HARTUNG, Portsmouth, Va., assigned to THE BASTIAN-BLESSING CO., Chicago. Filed Jan. 8, 1945. Issued March 26, 1946.

In a torch tip, means defining a plurality of gas passages through which streams of a combustible fuel and oxygen mixture are conducted. These passages terminate in ports through which the streams are discharged in approximately parallel relationship. A wall extending beyond the ports parallels the combustible fuel passages and terminates in a flange lying partly within a projection of the ports with respect to the path of the streams.

☆ ☆

Soldering Apparatus

2,397,052. JAMES R. SCHIETINGER, Baltimore, Md., assigned to WESTERN ELECTRIC CO., INC., New York City. Filed Sept. 2, 1943. Issued March 19, 1946.

A fixture comprising a pair of sockets for holding terminals to be soldered to a cable. The end of the cable is secured so that the conductors are in alignment with terminals positioned in the sockets. Two pairs of individually movable carbon electrodes selectively engage the terminals to heat them.

☆ ☆

Flint for Torch Lighters

2,396,636. HAROLD MARLAND BROADHURST, Liverpool, England, assigned to IMPERIAL CHEMICAL INDUSTRIES LIMITED, Great Britain. Filed July 7, 1944 (in Great Britain Aug. 4, 1943). Issued March 19, 1946.

A process for casting the rare earth metals for the production of alloy flints suitable for use in torch lighters having improved resistance to atmospheric disintegration. The rare earth metal alloy is cast in a ferrous metal mould, the surface layers of which have been converted by treatment under oxidizing conditions to a continuous film of black iron oxide.

Are YOUR WELDING OPERATIONS LIKE A TRAFFIC LIGHT?

● You can eliminate costly "Stop-Go, Stop-Go" operations in your shop by installing the RegO Manifold designed for your requirements.

You not only gain the advantage of uninterrupted operations, but also save valuable production space and eliminate hazards.

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How do *you* measure Manpower?

• Does manpower in your welding department mean numbers of men — or do you, more logically, measure manpower in terms of production?

Because welding is becoming increasingly important in every phase of production today, it is important that your welding be done faster, better and more economically. If weldors are using cranes or spending time propping up, turning over and flopping their weldments, they are interrupting production and increasing costs on every foot of welding.

Investigate the demonstrated advantages of C-F Hand or Power-operated welding Positioners and see how they can help your weldors produce better, faster and more economical welding. Weldors can swing weldments into any position because every weld is downhand, larger electrodes can be used with resulting savings in time and material. For production welding, C-F Power-operated Positioners are unequalled—equipped with either variable or constant speed table rotation and power tilt, C-F Positioners have been setting new standards in production welding in many varied industries. Write for Bulletin WP-22 and more details.

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All these models assume a low, horizontal position. There are no obstructing handles to interfere with free movement of drills passing over clamped work. There is a size to meet every need.

MODEL KP 185 has solid bar.

MODEL KP 186 provides channel for positioning pressure spindle.

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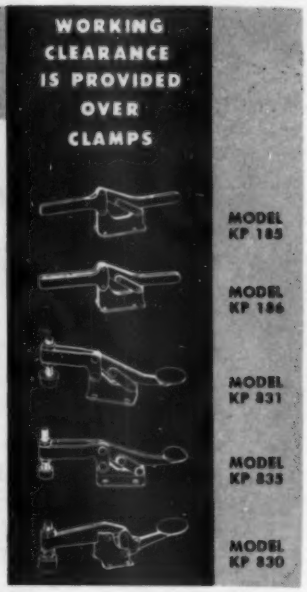
MODEL KP 830 has solid bar.



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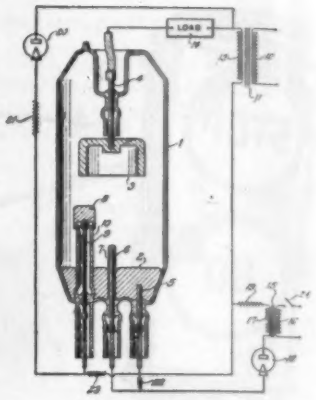
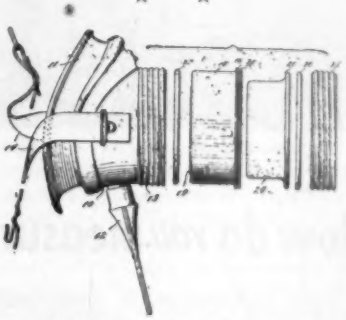


Ignitron Device

2,396,294. PERCY L. SPENCER, West Newton, Mass., assigned to RAYTHEON MANUFACTURING CO., Waltham, Mass. Filed Jan. 16, 1939. Issued March 12, 1946.

An ignitron tube comprising a sealed envelope containing a conducting liquid-pool cathode, an anode and an igniting electrode. The latter is electrically insulated from the pool cathode by a glass layer that is interposed between the pool and igniting electrode but is in contact with the surface of the pool. The glass layer has a thickness of the order of ten mils or less.

☆ ☆



Respirator Dust Filter

2,395,298. HOWARD L. SHOCK, JR., Brooklyn, assigned to PULMOSAN SAFETY CORP., Brooklyn. Filed June 10, 1944. Issued Feb. 19, 1946.

A respirator with a cylindrical intake into which fits a cup having a flanged end. A sealing ring of resilient, stretchable material is mounted on the cup between its flange and the open end of the cylindrical intake. There are also a filtering felt having a flange fitting the outer flange of the cup, a sealing ring between the cup and felt flaages, a protecting screen on the outer face of the felt and means for securing screen, felt and cup onto the cylindrical intake of the respirator.

☆ ☆

Induction-Heating Coil

2,397,629. NELSON B. STEVENS, Woodhaven, N. Y., assigned to INDUCTION HEATING CORP., New York City. Filed June 18, 1943. Issued April 2, 1946.

A high-frequency work coil for applying heat by magnetic induction inside a cavity of an object. The "coil" has the general shape of a hairpin the sides of which are bowed somewhat inwardly toward the longitudinal centerline. A cavity for cooling fluid is formed therein.

Filter Lens—for helmets and shields.

Cover Lens—for cup type goggles.

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> This process with Callite "Puretung" Electrodes, excludes all oxygen and other gases, insuring unusually ductile, smooth welds. It is especially advantageous when the tubing is worked afterward or when the application requires a smooth, bright surface. The welded section proves to be as strong as the tubing itself and has physical properties analogous to the parent metal.

In atomic hydrogen, helium or argon arc welding, "Puretung" Electrodes, of 99.9% pure tungsten, resist the extreme heat of the arc, retain their stiffness, keep the arc properly spaced . . . and are consumed slowly. Our engineers will be glad to advise on specific applications. Callite Tungsten Corporation, 545 Thirty-ninth Street, Union City, N. J. Branch Offices: Chicago, Cleveland.

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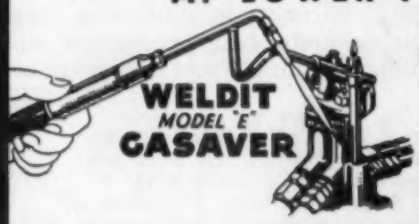
AT LOWER PRODUCTION COSTS



The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

Better Soldering, Annealing and Heating Jobs

The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

WELDIT INC.

628 BAGLEY AVENUE • DETROIT 26, MICH.

Eye Shield

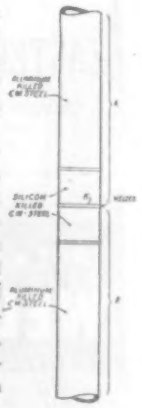
2,395,297. Howard L. Shock, Jr., Brooklyn, assigned to Pulmosan Safety Equipment Corp., Brooklyn. Filed June 10, 1944. Issued Feb. 19, 1946.

An eye shield comprising a plastic sheet bent to define a flat horizontal top having a straight front edge and straight side edges. The latter form a pair of downward side flanges at substantially a right angle to the plane of the top. A transparent wall extends downwardly from the front edge at substantially a right angle to the plane of said top and thence extends sidewise against the side flanges; wall curves in a conical curvature from front to sides. The top has a rear edge curved to fit a forehead, and the wall has a lower edge curved to fit the wearer's face below the eyes.

☆ ☆

Welded Pipe Product

2,396,704. Howard J. Kerr, Westfield, N. J., assigned to The Babcock & Wilcox Co., Rockleigh, N. J. Filed March 11, 1944. Issued March 19, 1946.

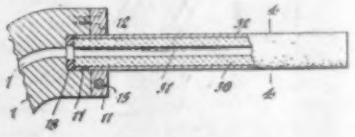


A composite tubular product constituting a component of heat-exchanger installation operating at high temperatures. The main body portion consists of an aluminum-killed carbon-molybdenum steel of abnormal carbide structure under the McQuaid-Ehn test. A small end section, of silicon-killed carbon - molybdenum steel of normal carbide structure under the McQuaid-Ehn test, is joined with a marginal portion of the main body portion by a weld. The weld and the main body portion are of normalized grain structure.

☆ ☆

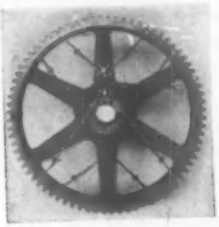
Underwater Cutting Electrode

2,398,427. Ernst Hediger, Niagara Falls, N. Y., assigned to The Carborundum Co., Niagara Falls, N. Y. Filed Sept. 3, 1943. Issued April 16, 1946.



An electrode for use in underwater cutting comprising a main body of silicon carbide and a continuous protective sheath of much lower electrical resistance. The sheath is attached to the main body for substantially its full length and constitutes a low-resistance path for the current from the point of attachment of the conductor to the working end of the electrode.

Clamp!
Hold!
Position!
Parts for Welding



The Simplex Util-A-Tool saves time and money on every welding job where it is used to clamp or hold parts together. Its 10-ton capacity assures ample holding power and safety. Also pushes, pulls, spreads, lifts, pulls wheels. Write for Bulletin P&P 45.

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LEVER SCREW - HYDRAULIC
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Chicago (44), Illinois
Better, Safer Jacks Since 1899

Supersonic Inspection Device

2,398,701. FLOYD A. FIRESTONE, Ann Arbor, Mich., assigned to UNITED AIRCRAFT CORP., East Hartford, Conn. Filed June 29, 1942. Issued April 16, 1946.

In a device for the inspection or measurment of a part by means of supersonic vibration, waves having means for producing a supersonic voltage train and an electromechanical transducer having its sensitive area in effective contact with the part to be inspected. The transducer radiates vibration wave trains into the part and generates voltage trains in response to the wave trains reflected within the part. Actuated by the transducer is a heterodyne amplifier having an intermediate frequency higher than the frequency of the alternations produced by the voltage train producing means; the amplifier actuates a means for indicating the time intervals between the voltage trains.

☆ ☆

Heating Head

2,397,442. HOWARD E. SOMES, Detroit, assigned to BUDD INDUCTION HEATING, INC., Philadelphia. Filed Dec. 30, 1943. Issued March 26, 1946.

In an induction-heating device a hollow current-conducting mandrel on which is located a head having a pocket opening through one side. A current-conducting arbor is located within the mandrel and a magnetic core is mounted on and entirely surrounds the mandrel adjacent the head. An inductor coil surrounds the core with one end extending into the pocket.

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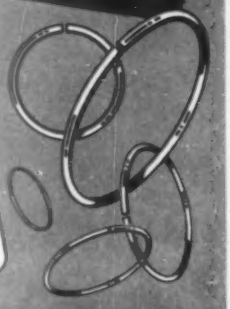

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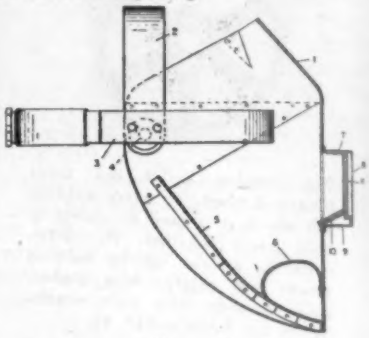
Important: These companies are not connected with any other producer of Carbide.

Face Shield

2,395,053. GEORGE G. LANDIS, University Heights, O., assigned to THE LINCOLN ELECTRIC CO., Cleveland. Filed April 16, 1943. Issued Feb. 19, 1946.

A weldor's shield comprising a face mask of light-impervious material having an opening in its central portion. A boxlike extension of light-impervious material fits over the opening; this extension has one opening in its forward wall and another in its lower wall. A semiopaque lens is placed in the first opening and a more transparent lens in the second opening.



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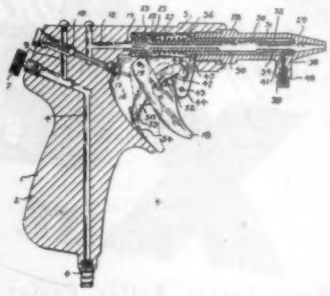
Gas Torch

2,394,349. PETER WILSON, Vancouver, British Columbia, Canada. Filed Aug. 28, 1943. Issued Feb. 5, 1946.

A torch with an abrasive igniter within an ignition chamber inside the tip. A means concentric with the tip normally closes off the chamber from the gas jet. A means is provided to open the closure and another means to actuate the igniter when the closure is being returned to its normal position.



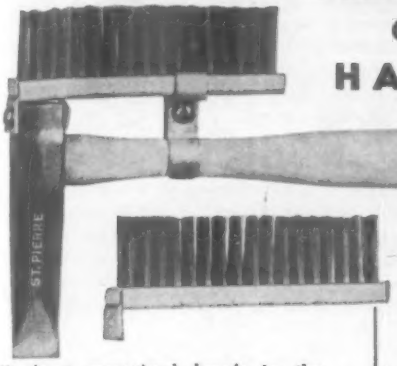
☆ ☆

Variable Resistance

2,396,970. FLOYD E. RILING, Anderson, Ind., assigned to P. R. MALLORY & CO., INC., Indianapolis. Filed Feb. 2, 1944. Issued March 19, 1946.

A variable resistance comprising a base, an annular resistance element, a rotatable shaft and a metallic contact arm insulatedly secured to the shaft. The latter is adapted to make sliding contact with progressive portions of the resistance element during rotary displacement of the shaft. A conically wound spiral spring is connected to the contact arm at the end closest to its axis. The end most distant from its axis is connected to a fixed terminal. The winding direction of the spiral is so determined with respect to the direction of rotation of the shaft that in the initial position the turns of wire are spaced from the shaft and during rotation the turns are forced away from said shaft and will prevent electrical contact with it.

ABUSE MEANS NOTHING TO ST. PIERRE CHIPPING HAMMERS



Here's a man-sized brush in the right position for easy use after chipping scale from welded surface. Hammer-Chisel made of highest quality tool steel. Entire tool is well-balanced. For economy, for durability use ST. PIERRE Hammers.

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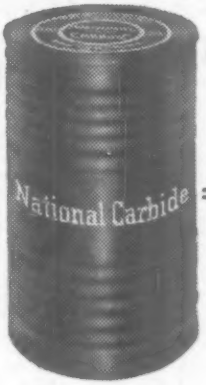

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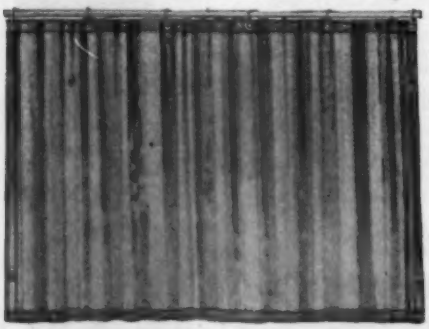

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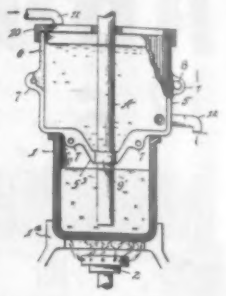
404 Denckla Bldg. Philadelphia 7, Pa.

Flame-Softening Apparatus

2,396,850. LYMAN S. HUGHES, Peoria, Ill. Filed March 12, 1945. Issued March 19, 1946.



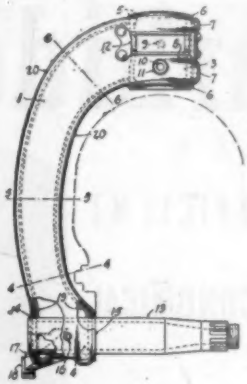
Apparatus for flame-softening an extremity of a hardened steel shaftlike member while maintaining hardness of the balance. It includes a cooling chamber holding a cooling medium designed to circulate continuous movement. The chamber has aligned openings in the opposite walls and these are adapted to receive a shaft of material to be heat treated in such a manner that one end of the shaft extends into a heating chamber adjacent the cooling chamber. Heating means associated with the latter chamber heats the projecting end of the shaft.

☆ ☆

Welded Landing Gear Strut

2,395,690. DONALD W. SHERMAN, Shorewood, Wis., assigned to A. O. SMITH CORP., Milwaukee. Filed Nov. 10, 1941. Issued Feb. 26, 1946.

A pressed-steel landing gear strut for airplanes comprising a tubular body curved downwardly to a lower hub carrying an axle for a supporting wheel. The curved body is formed from two complementary channel-shaped halves. The longitudinal edges of these halves are disposed in abutting relation on the outside and inside of the curve, respectively, and are then welded together.



☆ ☆

Induction-Heating Apparatus

2,397,990. VERNON W. SHERMAN, Summit, N. J., assigned to FEDERAL TELEPHONE & RADIO CORP., New York City. Filed March 12, 1943. Issued April 9, 1946.

A high-frequency induction-heating apparatus comprising an inductor element formed as a split ring of continuous vee-formed channel section. The apex of the vee is disposed inwardly toward the work surface to be heated. Outwardly extending terminal members are connected to the respective ends of the inductor in closely spaced and insulated relation. A tubular cooling coil sets within the groove of the inductor, which is silver plated to minimize eddy current losses.

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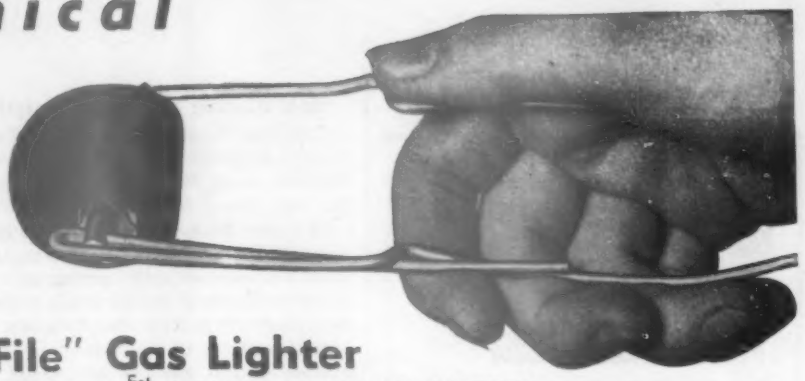

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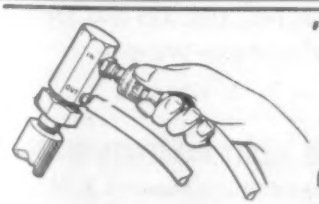

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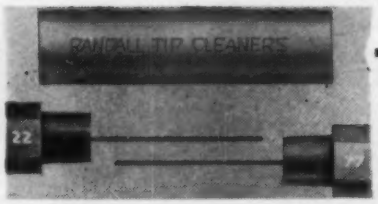

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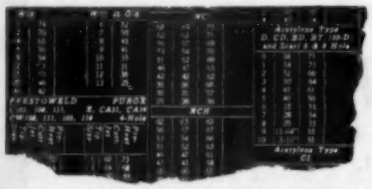

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Metallizing Gun Construction

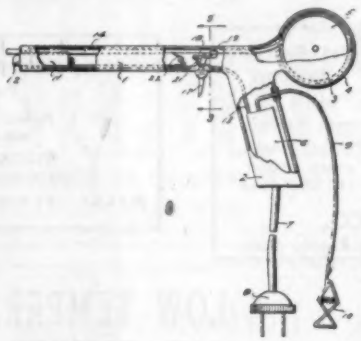
2,397,165. ARTHUR P. SHEPARD, Flushing, N. Y., assigned to METALLIZING ENGINEERING CO., INC., Long Island City, N. Y. Filed Oct. 25, 1943. Issued March 26, 1946.

In a gun for metal spraying, an improvement which includes a rear annular first manifold concentrically arranged with respect to the axis of the gas nozzle and defined by a groove in at least one of the two mating conical surfaces of the nozzle. A multiple number of first gas jets are evenly spaced around the axis, each ending with its outlet in the first manifold, to which a fuel and a combustion-supporting gas are supplied at relatively low pressure. An annular second manifold supplies a fuel gas and a combustion-supporting gas at relatively high pressure to each of the first gas jets. A multiple number of second gas jets, one for each of the first gas jets, are designed with internally streamlined surfaces shaped for free non-turbulent gas flow. Each of the second jets leads from the first manifold and is positioned with its inlet in gas flow directional alignment with the outlet of the corresponding first gas jet. The outlet of each first gas jet is smaller than the inlet of its second gas jet, and the first manifold extends across the inlet of each second gas jet to permit gas to flow from the manifold into and from all sides of the inlets. Removably mounted on the gas nozzle rear portion are a multiple number of third gas jets, one for each of said second gas jets, in which they are in approximate alignment. A groove on at least one of the mating surfaces of the gas nozzle rear and tip portions substantially connects all of the second gas jet outlets with the third gas jet inlets.

☆ ☆

Electric Soldering Iron

2,396,799. FRANK D. MCCULLY, Joseph, Ore. Filed Feb. 28, 1944. Issued March 19, 1946.



An electric soldering iron with a cylindrical one piece barrel and a hollow handle depending from one end. A magazine is on the same end of the barrel and a reel is rotatably mounted in the magazine. A length of solder is wound on the reel with an end portion extending longitudinally through the barrel and is fed manually by a means consisting of a trigger pivoted in front of the handle and a pawl mounted to rock on the trigger and provided with a segmental saddle in which the solder rides in passing through the barrel. A tooth in the saddle grips upon the trigger being pressed and the pawl causes forward motion of the solder. The transformer for providing current to melt the solder is mounted in the handle.

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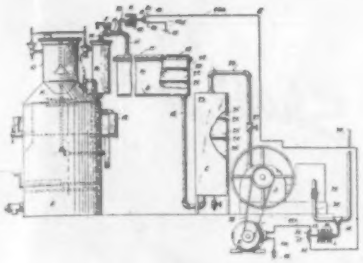


Acetylene Generator

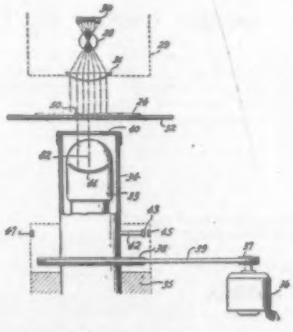
2,399,058. PETER PEFF, Reno, Nev. Filed May 22, 1945. Issued April 23, 1946.

Elements of this acetylene generator are: a closed chamber containing a purifying agent, a closed drying chamber containing a drying agent, a compressor, a means to operate it, conduits connecting the generator and chambers in series to the suction side of the compressor, pressure-responsive means between the generator and compressor to stop the latter when the gas stream falls below a predetermined pressure, a second drying chamber and a cylinder-charging manifold. Conduits connect the discharge side of the compressor with the second drying chamber and manifold so that the compressed gas is forced in a confined stream to the manifold. A pressure-responsive means between the compressor and manifold stops the compressor when the gas stream exceeds a predetermined pressure.

☆ ☆

Electronic Tracing Unit

2,397,933. JOHN M. FOWLE, Piedmont, and HARRY E. KENNEDY, Berkeley, Calif., assigned to THE LINDE AIR PRODUCTS CO., New York City. Filed Feb. 19, 1943. Issued April 9, 1946.



A tracing device for flame-cutting in which the required contour is scanned by a beam of radiant energy subject to alternately increasing and decreasing cycles of uniform frequency. Successively completed power circuits propel the beam and contour in successive angular directions; these circuits are energized in response to impulses for each cycle proportional to the portion of energy escaping the contour to the portion affected during each cycle. The power circuits relatively propel the contour and beam along the contour in response to a part of each impulse. The power circuits also correct the alignment of the direction of the propulsion with respect to the direction of the contour in response to the remainder of each impulse by relatively moving the beam and contour toward each other during one period of each impulse and away from each other during another period.

Tube Mill

2,398,937. RAYMOND H. HOBROCK, Oakland County, Mich., assigned to BUNDY TUBING Co., Detroit. Filed Jan. 3, 1944. Issued April 23, 1946.

A machine for forming and welding tubing and adding a bonded coating of higher electrical conductivity than the tubular stock. A strip of steel stock is fashioned into hollow tube form and its edges are brought into contact and weld united as the formed tube moves through a welding throat between electrodes contacting the tube on opposite sides of the seam. A coating of metal is then bonded on the steel stock by contacting the coated surfaces of the formed tube with the electrodes.

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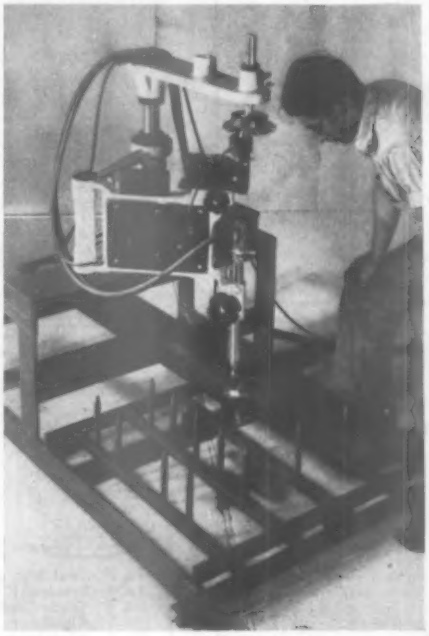

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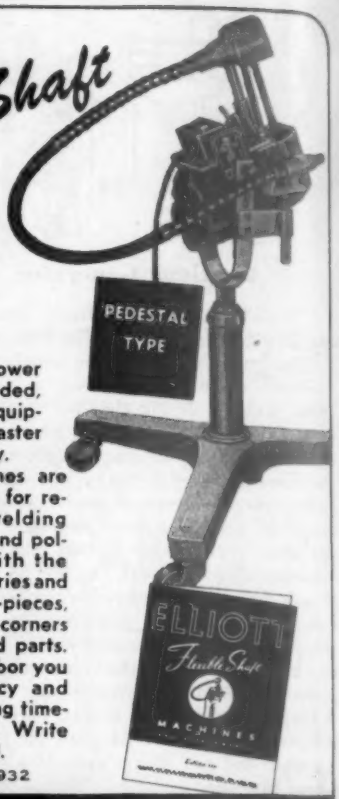

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